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Subject: NDWAC LCR Work Group - final report
Attachments: removed.txt; NDWAC LCR Work Group Report Final 08 24 2015.pdf

Dear Peter, Eric, and Michelle

It is my great pleasure, on behalf of the Lead and Copper Work Group, to ask you to convey their final report to the National Drinking Water Advisory Council. The work group met seven times in person and numerous times by webinar and in small group conference calls, and I know greatly appreciated the opportunity to work collaboratively with one another and with EPA on this important national primary drinking water regulation.

Respectfully, Gail Bingham (facilitator)

Gail Bingham, President Emeritus

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Report of the Lead and Copper Rule Working Group To the National Drinking Water Advisory Council

FINAL

AUGUST 24, 2015

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Figure 1 – Overview of Recommended Revised Lead and Copper Rule Framework

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Abbreviations

AL – Action Level
ALE – Action Level Exceedance
CCR – Consumer Confidence Report
CCT – Corrosion Control Treatment
DWLRP – Drinking Water Lead Reduction Plan
EPA – Environmental Protection Agency
LAL – Lead Action Level
LCR – Lead and Copper Rule
LCRWG – Lead and Copper Rule Working Group
LSL – Lead Service Line
LSLR – Lead Service Line Replacement
LTR LCR – Long Term Revisions to the Lead and Copper Rule
MCLG – Maximum Contaminant Level Goal
mg/L – Milligram per Liter
µg/L – Microgram per Liter
µg/dL – Microgram per Deciliter
NDWAC – National Drinking Water Advisory Council
OGWDW – Office of Ground Water and Drinking Water
OCCT – Optimum Corrosion Control Treatment
OWQP – Optimal Water Quality Parameter
PE – Public Education
pH – Negative log of hydrogen ion molar concentration
PLSLR – Partial Lead Service Line Replacement
POTW – Publicly Owned Treatment Works
POU – Point-of-use Treatment Device
PWS – Public Water System
SAB – Science Advisory Board
SDWA – Safe Drinking Water Act
DWSRF – Drinking Water State Revolving Fund
TT – Treatment Technique
WQP – Water Quality Parameter

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Report of the Lead and Copper Rule Working Group to the National Drinking Water Advisory Council

1. Executive Summary

The Lead and Copper Rule Working Group (LCRWG) of the National Drinking Water Advisory Council (NDWAC) has completed its deliberations on issues associated with long term revisions to the Lead and Copper Rule (LCR). This report includes the group's findings and recommendations.

This executive summary provides a brief overview of the report. Details of the findings and recommendations are provided in the body of the report. A list of the members of the working group can be found in Appendix A.

1.1. Charge

The charge to the LCRWG was to provide advice to the NDWAC as it develops recommendations for the U.S. Environmental Protection Agency (EPA) on targeted issues related to long term revisions to the Lead and Copper Rule under the Safe Drinking Water Act (SDWA).

1.2. Findings and Recommendations

The anticipated Long Term Revisions to the Lead and Copper Rule (LTR LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential.

The LCRWG took the following considerations, among others, into account in making recommendations for revisions to the LCR. A more detailed list of considerations is included in the full report.

There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for pregnant women, infants and young children and other vulnerable populations with both acute and chronic exposures. Effective elimination of leaded materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility; public water systems (PWSs), consumers, building owners, public health officials and others each have important roles to play. The lack of resources to reduce the sources of exposure in some communities, however, also raises important questions of disparate impact and environmental justice. Thus, creative financing mechanisms will be needed.

The LCR should remain a treatment technique rule, but it can be improved based on the scientific knowledge that has emerged since the current LCR was promulgated. Corrosion control treatment is complicated, and will vary based on specific circumstances in each public water system. Thus, regular updates to guidance by EPA based on the latest science and the creation of a national clearinghouse of information both for the public and for PWSs are needed.

The LCRWG considered but did not quantify the cost implications of its recommendations. An important factor in the group's deliberations was the principle that PWS and state resources should be focused on actions that achieve the greatest public health protection. Recognizing that lead service line (LSL) replacement programs will be costly in some locations, the LCRWG also encourages PWSs to incorporate

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anticipated costs into their capital improvement program as appropriate to their situation, and urges states to include the costs of LSL replacement in their criteria for allocation of Drinking Water State Revolving Funds.
The LCRWG specifically recommends that EPA revise the LCR to:

- Require proactive lead service line (LSL) replacement programs, which set replacement goals, effectively engage customers in implementing those goals, and provide improved access to information about LSLs, in place of current requirements in which LSLs must be replaced only after a lead action level (AL) exceedance;
- Establish more robust public education requirements for lead and LSLs, by updating the Consumer Confidence Report (CCR), adding targeted outreach to consumers with lead service lines and other vulnerable populations (pregnant women and families with infants and young children), and increasing the information available to the public;
- Strengthen corrosion control treatment (CCT), retaining the current rule requirements to re-assess CCT if changes to source water or treatment are planned, adding a requirement to review updates to EPA guidance to determine if new scientific information warrants changes;
- Modify monitoring requirements to provide for consumer requested tap samples for lead and to utilize results of tap samples for lead to inform consumer action to reduce the risks in their homes, to inform the appropriate public health agency when results are above a designated household action level, and to assess the effectiveness of CCT and/or other reasons for elevated lead results;
- Tailor water quality parameters (WQPs) to the specific CCT plan for each system, and increase the frequency of WQP monitoring for process control;
- Establish a health-based, household action level that triggers a report to the consumer and to the applicable health agency for follow up;
- Separate the requirements for copper from those for lead and focus new requirements where water is corrosive to copper; and
- Establish appropriate compliance and enforcement mechanisms.

Although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other EPA offices; federal state and local agencies and other stakeholders. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

2. Considerations and Background Information

2.1. Considerations in Preparing this Report

The members of the LCRWG brought different perspectives and expertise to the preparation of this report. Although not all members agreed with each and every consideration listed below, the LCRWG took one another's perspectives into account and, thus, the following concepts collectively underlie the recommendations in this report. Additional detail is provided in the recommendations section below.

- There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for pregnant women, infants and children with both acute and chronic exposures.
- Lead-bearing plumbing materials in contact with drinking water pose a risk at all times (not just when there is a lead action level (LAL) exceedance).
- Effective elimination of leaded materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility. PWSs, consumers, building owners, public health officials and others each have important roles to play.
- The LTR LCR is an important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. However, additional action beyond the scope of the Safe Drinking Water Act is needed. Removing lead from drinking water systems also will require renewed commitment, cooperation and effort by government at all levels and by the general public. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)
- Proactive action is needed to remove the sources of lead, with appropriate incentives both for PWSs and their customers needed to encourage such action.
- Successful implementation of the revised LCR can only take place in the context of a more holistic effort on lead in water issues involving stakeholders other than just EPA and water systems, and resources beyond those able to be brought to bear by water systems. Partnerships at all levels are essential. Recognizing that public agency budgets are tighter than ever, greater engagement by local health agencies, those funding housing programs, and those involved in permitting and construction is particularly important.
- Creative financing mechanisms also will be needed to achieve this goal for all individuals potentially exposed to lead, regardless of race, ethnicity or income. Leaving a lead service line in place because a low-income resident does not have the means to pay raises serious questions of disparate impact and environmental justice.
- The public plays a critical role in protecting their families' health by reducing exposure to lead and copper, and informing the public enables them to be effective participants in implementing their share of the responsibility.
- The issues associated with lead and copper are very different and warrant more separate attention than has been the case in the past.
- The LCR should remain a treatment technique rule, but it can be improved.
- Corrosion control treatment (CCT) is complex, dynamic, and varies based on the circumstances in each PWS. The understanding of the challenges with CCT has improved in recent years, but questions still remain.
- Attention to unintended consequences is important generally and, in particular, with respect to CCT.
- The presence of lead-bearing materials in premise plumbing raises issues about what systems can implement in customers' homes.
- Attention to what States are able to oversee and enforce also is important.
- PWS and state resources should be focused on actions that achieve the greatest public health protection.

2.2 Regulatory Background and Formation of the NDWAC Lead and Copper Work Group

Under the Safe Drinking Water Act EPA sets public health goals and enforceable standards for drinking water quality.[1] The Lead and Copper Rule is a treatment technique rule. Instead of setting a maximum contaminant level (MCL) for lead or copper, the rule requires (PWSs) to take certain actions to minimize lead and copper in drinking water, to reduce water corrosivity and prevent the leaching of these metals from the premise plumbing and drinking water distribution system components and when that isn't enough, to replace lead service lines under their control. The current rule sets an action level (AL), or concentration, of 0.015 mg/L for lead and 1.3 mg/L for copper. An AL is not the same as an MCL. An MCL is based on health effects and feasibility; whereas an action level is a screening tool for determining when certain treatment technique actions are needed.

The LCR action level is based on the practical feasibility of reducing lead through controlling corrosion. In the LCR, if the AL is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the AL), it is not a violation, but triggers other requirements that include water quality parameter monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education, and lead service line replacement (LSLR). The rule also requires States to report the 90th percentile for lead concentrations to EPA's Safe Drinking Water Information System (SDWIS) database for all water systems serving 3,300 or more persons, and for those systems serving fewer than 3,300 persons only when the lead action level (LAL) is exceeded. States only report the 90th percentile for copper concentrations in SDWIS when the copper action level is exceeded in water systems regardless of the size of the service population. Public education requirements ensure that drinking water consumers receive meaningful, timely, and useful information that is needed to help them limit their exposure to lead in drinking water.

Copper is a common material used in household plumbing and drinking water service lines in the United States. Copper is an essential nutrient in small amounts; however, acute ingestion of excess copper in drinking water has been associated with adverse health effects, including acute gastrointestinal symptoms such as abdominal discomfort, nausea, and vomiting.

The SDWA requires EPA to set MCLGs at concentration levels at which no known or anticipated adverse effects would occur, allowing for an adequate margin of safety. EPA proposed an MCLG of 1.3 mg/l for copper in 1985, and finalized that MCLG in 1991 when the LCR was promulgated. The LCR set the action level (AL) for copper, the level at which treatment technique actions are triggered for the water system, equal to the MCLG. The AL is triggered if the 90th percentile level of water samples is exceeded. All community water systems must report the 90th percentile level and the number of samples that exceeded the 90th percentile in their Consumer Confidence Reports.

In early 2004, EPA began a wide-ranging review of the implementation of the LCR to determine if there was a national problem related to elevated levels of lead in drinking water. As part of its national review, EPA collected and analyzed lead concentration data and other information, carried out a review of implementation in States, held four expert workshops to discuss elements of the regulations, and worked to understand local and State efforts to monitor for lead in school drinking water, including a national meeting to discuss challenges and needs. EPA released a Drinking Water Lead Reduction Plan (DWLRP) in March 2005. This plan outlined short-term and long-term goals for improving implementation of the

[1] EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

LCR. The plan can be found at the following web address:
http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_review.cfm

In 2007, EPA promulgated regulations, which addressed the short-term revisions to the LCR that were identified in the 2005 DWLRP. These requirements enhanced the implementation of the LCR in the areas of monitoring, treatment, LSLR, public education, and customer awareness. These revisions were intended to better ensure drinking water consumers receive meaningful, timely, and useful information needed to help them limit their exposure to lead in drinking water.

A number of Safe Drinking Water Act (SDWA) amendments aim to reduce lead in drinking water by limiting the amount of allowable lead in plumbing materials that come into contact with drinking water. In 1986, the SDWA was amended to prohibit the "use of any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, in the installation or repair of (i) any public water system; or (ii) any plumbing in a residential or non-residential facility providing water for human consumption, that is not lead free". Lead Free was defined as solder and flux with no more than 0.2% lead and pipes with no more than 8% lead.

Congress again amended the SDWA in 1996, to prohibit the introduction into commerce of any pipe, pipe or plumbing fitting or fixture that is not lead free and to also require pipes, pipe or plumbing fittings or fixtures be in compliance with 3rd party lead leaching standards. These provisions ensure that only products meeting the lead free definition are sold in the U.S. and that pipes, pipe or plumbing fittings or fixtures are certified to be lead free.

The Reduction of Lead in Drinking Water Act of 2011 revised the maximum allowable lead content from not more than 8% to not more than a weighted average of 0.25% lead and included a calculation procedure for determining the weighted average; further reducing the amount of lead in contact with drinking water. It also eliminates the federal requirement to comply with the lead leaching standard and included exemptions from the lead free definition for plumbing devices that are used exclusively for non-potable services and also for specific plumbing devices such as toilets, bidets and urinals. The Community Fire Safety Act of 2013 further amended the SDWA to add fire hydrants to the list of exempted plumbing devices.

EPA has continued to work on the long-term issues that required additional data collection, research, analysis, and full stakeholder involvement, which were identified in the 2005 DWLRP and the 2007 rule revisions. This action is referred to as the LCR Long-Term Revisions (LTR). The LCR LTR would apply to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). In this report, the term public water system (PWS) is meant to refer to both of these categories but not to transient non-community water systems.

Seeing the need for additional input on potential revisions to the Lead and Copper Rule, EPA requested that the National Drinking Water Advisory Committee (NDWAC) form the Lead and Copper Rule Working Group (LCRWG) to consider several key questions for the LCR LTR, taking into consideration previous input. The LCRWG met seven times in 2014 and 2015 to produce this report, and sought input from the NDWAC in advance of the last meeting to understand and address questions the NDWAC might have about the working group's recommendations.

A list of members of the working group is provided in Appendix A. This report was approved by the LCRWG, with one dissent.

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3. Recommendations for Revisions to the Lead and Copper Rule

The long term revisions to the LCR is an important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential.

The LCRWG offers the following recommendations, based on information provided to the work group and on the work group's own deliberations. The LCRWG considers these recommendations to be an integrated package, not a menu of choices from which some recommendations can be selected and combined with others. This package reflects a concerted attempt to strengthen public health protection, which includes targeting the resources available to PWSs for the greatest public health value. While individual members might differ on specific recommendations, the work group (with one dissent) agrees that this package of recommendations constitutes an improvement over the current LCR.

The LCRWG carefully considered the information and questions posed by EPA in a white paper prepared for the working group. In its deliberations, the LCRWG came to the conclusion that the lessons learned from the implementation of the current LCR warranted a fresh look at the premises of the regulation. To truly solve the problem of exposure to lead in drinking water, the LCRWG concluded that lead-bearing materials should be removed from contact with drinking water to the greatest degree possible, while minimizing the risk of exposure in the meantime. That premise has led to a different paradigm for a revised LCR and, thus, to a somewhat different set of assumptions than underlay questions posed to the working group.

The diagram on page 12 illustrates the conceptual framework of the recommendations that follow.

The LCRWG specifically recommends that EPA revise the LCR to:

- Require proactive LSL replacement programs, which set replacement goals, effectively engage customers in implementing those goals, and provide improved access to information about LSLs, in place of current requirements in which lead service lines (LSLs) must be replaced only after a lead action level (AL) exceedance and CCT;
- Establishes more robust public education, by creating a national clearinghouse of information for the public and templates for PWSs, by updating the Consumer Confidence Report, adding targeted outreach to consumers with lead service lines and other vulnerable populations (pregnant women and families with infants and young children), and increasing the information available to health care providers and the public;
- Strengthen corrosion control treatment (CCT), retaining the current rule requirements to re-assess CCT if changes to source water or treatment are planned, adding a requirement to review updates to EPA guidance to determine if new scientific information warrants changes;
- Modify monitoring requirements to provide for consumer requested tap samples for lead and to utilize results of tap samples for lead to inform consumer action to reduce the risks in their homes, to inform the appropriate public health agency when results are above a designated household action level, and to assess the effectiveness of CCT and/or other reasons for elevated lead results;
- Tailor water quality parameters to the specific CCT plan for each system, and increases the frequency of WQP monitoring for process control;

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- Establish a health-based, household action level that triggers a report to the consumer and to the applicable health agency for follow up;
- Separate the requirements for copper from those for lead and focus new requirements where water is corrosive to copper; and
- Establish appropriate compliance and enforcement mechanisms.

Although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other EPA offices; federal, state and local agencies and other stakeholders. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

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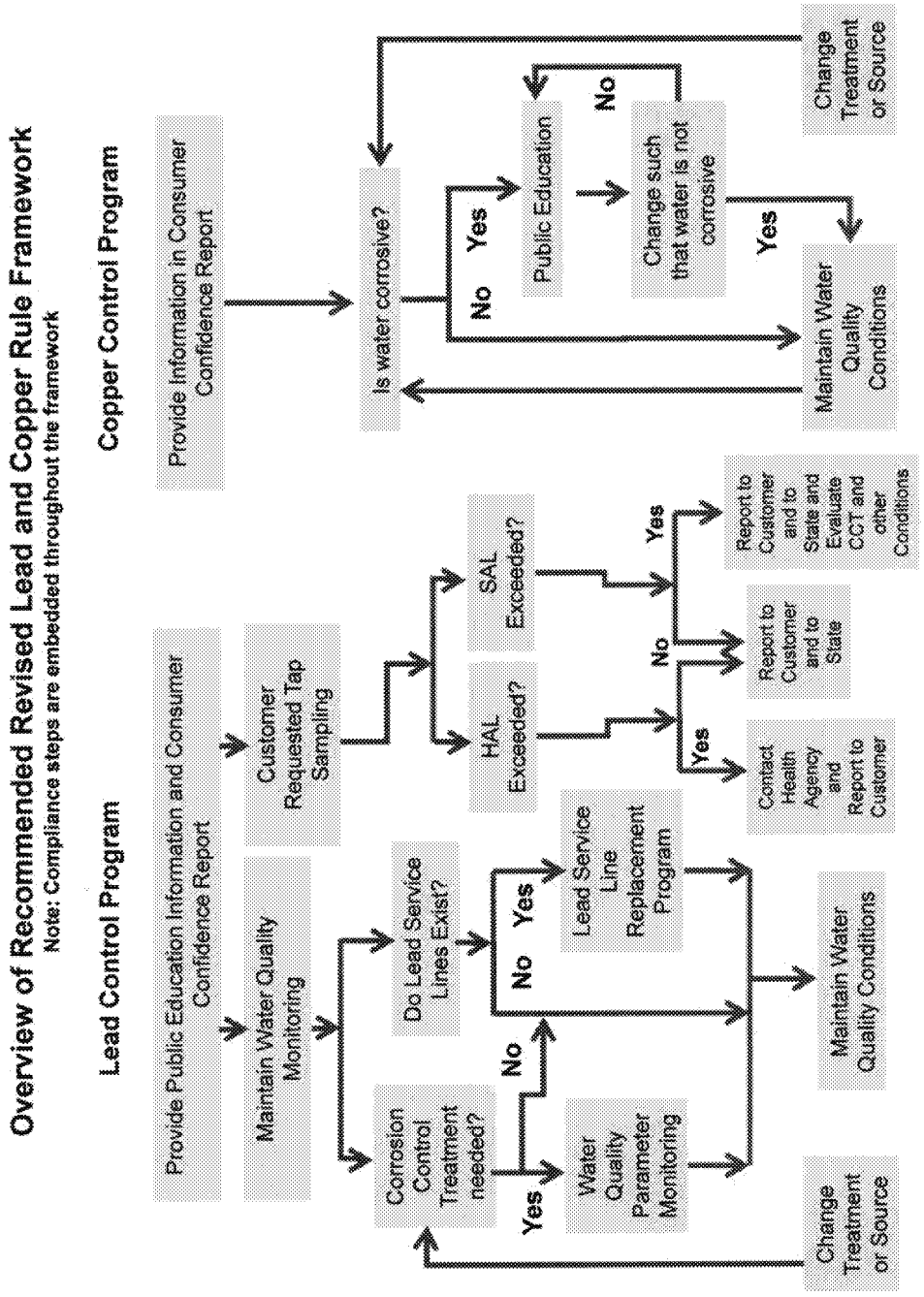
Figure 1



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3.1. Replace Lead Service Lines[2]

Removing the sources of lead in drinking water should be a national goal. More proactive action than has taken place to date is needed to achieve it.

Although success in achieving this goal will require a concerted effort by many and can not be accomplished solely through the authorities provided under the Safe Drinking Water Act, revisions to the Lead and Copper Rule are an important component to achieving this goal and should be structured accordingly. [See Section 4 for recommendations that complement revisions to the LCR.]

The existing LCR has not created sufficient incentives to fully replace LSLs and other sources of lead , because LSL replacement is only required when the lead AL has been exceeded and optimizing CCT is insufficient to bring a system back under the action level. Systems that do not exceed the lead AL will never have to implement a LSL replacement program. Further, the link to action level exceedance does not allow adequate time for a well-planned LSLR program, and a significant unintended consequence where systems have had to implement a LSL replacement program quickly has been an increase in partial LSL replacement.

EPA asked the Science Advisory Board (SAB) to evaluate the current scientific data regarding the effectiveness of PLSLR and the review centered around five issues: (1) associations between PLSLR and blood lead levels in children; (2) lead tap water sampling data before and after PLSLR; (3) comparisons between partial and full LSLR; (4) PLSLR techniques; and (5) the impact of galvanic corrosion. The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of PLSLR in reducing drinking water lead concentrations. The small number of studies available had major limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating PLSLR efficacy.

While recognizing the limits to current data, the SAB concluded that PLSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months, and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to increase then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR. The SAB also concluded that in studies comparing full LSLR versus PLSLR, the evaluation periods were too short to fully assess differential reductions in drinking water lead levels. However, the SAB explained that full LSLR appears generally effective in achieving long-term reductions in drinking water lead levels, unlike PLSLR. Both full LSLR and PLSLR generally result in elevated lead levels for a variable period of time after replacement. The limited evidence available suggests that the duration and magnitude of the elevations may be greater with PLSLR than full LSLR.

Taking all of these considerations into account, the LCRWG has concluded that an effective framework for replacement of LSLs would include the following and, thus, the LCR should be revised accordingly:

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[2] 40 CFR 141.2 defines: "*Lead service line* means a service made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line."

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- Requiring all PWSs to establish a LSL replacement program that effectively informs and engages customers to share appropriately in fully removing LSLs, unless they can demonstrate that LSLs are not present in their system;
- Modifying the definition of lead service lines to include any service line where any portion, including a lead pigtail, gooseneck or other fitting, is made of lead;
- Clear guidance, case studies, and templates for LSL replacement programs, including a toolkit of ideas for creative financing strategies;
- Targeted outreach to customers with LSLs, with information about the risks of lead exposure, an offer to test a tap sample, and information about and encouragement to participate in the LSL replacement program;
- Dates by which systems should have met interim goals and completed replacement of all LSLs and PLSLs, without penalty to PWSs for those homeowners who refuse to participate in the replacement program as long as the PWS has made a meaningful effort to work with such a homeowner;
- Creating incentives for understanding where LSLs and PLSLs exist, while making action on full replacement, rather than on investigation of the location of LSLs and PLSLs the priority;
- Maintaining ongoing-outreach to homeowners where LSLs or PLSLs still exist;
- Implementation of standard operating procedures (SOPs), either from EPA guidance or tailored to the system, that helps define operations that disturb LSLs and practices to minimize disturbance and consumer exposure to lead;
- Stronger programs to educate consumers, and to provide test results of tap samples at the request of consumers;
- Focus efforts on action to replace LSLs rather than on the time and expense of upfront plan approval and on using simplified reporting to the states so they would only need to intervene when problems arise; and
- Requirements that provide strong encouragement for full LSL replacements, with the understanding that there may be justifiable exceptions and that those exceptions would occur only after the efforts outlined in the recommendations below on the part of the PWS to work with customers to complete a full LSL replacement. Such exceptions might include emergency repairs where property owners have refused to participate in a full LSL replacement; during a main replacement project; or when a sufficiently high percentage of property owners participate in an area-wide LSL replacement project to justify replacing LSLs to the property lines of those who do not participate at the time. Revisions to the LCR should include options for risk management to occupants of those properties with remaining, partial lead service lines, e.g. additional sampling, filters, dielectrics to reduce the risk of galvanic corrosion, plastic piping, aggressive premise flushing, etc.

3.1.1. Update Inventories and Improve Access to Information about Lead Service Lines

Updating and improving access to information about the location of both full and partial lead service lines is both essential to ensuring LSLs are replaced and important for successful, proactive outreach to customers who are most likely to have a LSL.

The LCRWG recommends combining:

1) The presumption that a service line put in place prior to the date when lead service lines were prohibited has leaded materials unless the PWS has information to confirm that it not, with

2) Providing credit to a PWS toward its replacement goals for demonstrating that a service line presumed to include lead does not have leaded materials.

This approach is intended to create incentives for prompt action to develop an accurate inventory of LSLs and PLSLs in part by being overly conservative initially on the potential existence of LSLs, time to organize an effective replacement program, and an opportunity to take action to replace LSLs rather than devoting time and resources on planning documents that must be approved by the primacy agency.

The LCRWG recognizes that PWSs vary in the amount of information they have about the location of full and partial LSLs. EPA should take the impact on small and medium systems into account when developing the proposed rule.

The LCRWG also recognizes that the current definition of a lead service line exempts a service line that has a lead pigtail or gooseneck or other fitting but is otherwise not made of lead. We recommend that the LCR be revised to remove this exemption since a lead pipe, even if only a small portion, poses a sufficiently similar risk as a full lead service line. Because utilities may not know where these portions are and may not be able to locate them without excavating, we recommend that the presumption described above not apply to lines where the utilities do not have information or are unaware of their use. Finally, we recommend that these fittings be replaced when they are encountered during excavations and that the applicable operations and customer engagement requirements described in the next section apply.

In addition, the LCRWG recommends that all PWSs should establish a clear mechanism for customers to access information on LSL locations (at a minimum). Detailed public education recommendations for both lead and copper follow in separate sections. With respect to information about LSLs, PWSs should:

- Have outreach materials that indicate that property specific information is available.
- Inform customers who may have LSLs about the risks of partial line replacement, who is responsible for paying for replacing the service line, and the legal basis of that determination.
- Provide information it has about LSLs to existing home owners and residents on request.
- Provide information to realtors, home inspectors, and potential home buyers on request
- Communicate that this information is subject to disclaimer for accuracy based on information available to the PWS.
- Develop a system to track LSL replacement.

Where a service line serves multiple dwellings or places such as schools or child care centers that have many children, EPA should establish a formula for giving an extra weight or numerical count to these

lines in the initial inventory to recognize the additional children that would be affected and effectively prioritize replacement of these LSLs.

3.1.2. Establish Active LSL Replacement Programs

Proactive LSL replacement programs by PWSs and their customers are key to moving to a future in which lead is not in contact with drinking water. To accomplish this, the LCRWG recommends replacing the current regulations, in which LSL replacement is required only if a PWS has a lead AL exceedance and after the PWS takes action to operate CCT, because this has not resulted in the complete replacement of many LSLs across the country. [3]

Instead, a revised LCR should include a requirement that all PWSs with lead service lines prepare and implement a LSL replacement program, along with a combination of changes to the regulatory approach described in this report and supportive actions by other public and private agencies, customers and other stakeholders. Taking this approach has the advantages of making replacement of LSLs something all systems do and of establishing programs that are put in place in an organized and measured way.

Supportive actions include increased funding of federal lead risk reduction programs under the Department of Housing and Urban Development (HUD) to help fund customer-owned portions of LSLs and to consider federal tax deductions for this purpose. Additionally, states should pass legislation requiring inspection, disclosure and/or replacement of LSLs on sale of property, and when lines have been disturbed as part of a renovation. Details on these and other ideas are included in Section 4 of this report.

The LCRWG recommends that EPA include the following revisions to the LCR:

1. *Goal:* PWSs will work with their customers to implement full replacement of all lead service lines in their service areas according to the milestones outlined in Table 1. Revisions to the LCR should maximize the likelihood of achieving this goal, consistent with the recommendations in this section. EPA should urges PWSs to work with their customers to replace LSLs in their service areas more quickly, while recognizing that the recommended approach of replacing LSLs in all PWSs with LSLs adds a new and potentially costly requirement for utilities and their customers with LSLs who currently are not and may not ever be triggered into a LSLR program under the current rule.

2. *Interim Milestones:* PWSs that identify LSLs in their inventory should be required to perform targeted outreach to customers on the inventory of LSLs and to work with them to replace LSLs according to a sequence of three-year milestones,[4] beginning 36 months after the effective date of a revised LCR. Milestones would be set at a faster pace in earlier years and would recognize progress may be more difficult to achieve in later years with those LSLs that remain at that time. Table 1provides an illustration of this concept. PWSs should be encouraged to contact a larger number of homeowners than needed for compliance, since some homeowners may fail to reply or may refuse to participate. If replacement goals are not met, the revised LCR should require the PWS to take additional actions intended to enhance interest in and incentives for customer participation in full LSL replacement. The details of this approach should be determined by EPA with the intent of the LCRWG being that the PWS be given the flexibility to choose among

[3] EPA estimates that there were approximately 10.5 million LSLs in 1988 before the promulgation of the LCR and approximately 7.3 million LSLs now.
[4] Three years is a standard reporting timetable for drinking water regulations.

options that are appropriate for the size and type of ownership of the system and that the number of required efforts would increase over time if replacement goals are not met. EPA should seek to add to the initial list of options suggested in Table 2 to ensure a robust menu for PWSs to choose from (again considering system size and type of ownership) to avoid a situation where a PWS is forced into specific actions; and EPA should set the number of required efforts with consideration for the number and feasibility of choices provided.

3. *Replacement Credit:* The following actions can be counted toward the cumulative replacement requirement:

   - Full LSL replacement
   - Replacement of lead pigtail where the pigtail is the only leaded material on the service line
   - Confirmation that an LSL included in the initial inventory is not lead.

   PLSLR will not be counted toward this requirement. Lack of response or refusal to participate by the customer also will not count toward replacement milestones.

4. *Targeted Outreach*: EPA should create a list of options in the rule of approved outreach methods for contacting customers with LSLs and inviting them to participate in the utility's LSLR program. Table 2 provides an initial list of options for such resident engagement, along with additional system policies and other actions if milestones aren't met. EPA also should provide guidance and/or templates for these options. For compliance purposes, the revised LCR should require that a PWS individually notify customers with known or possible LSLs describing the risks of lead in drinking water, specifically inviting them to participate in the LSLR program, and clearly describing the terms of the program, and how to follow up. If the customer does not respond or chooses not to participate, the PWS must follow up with another invitation at least every three years and always when there is a new customer at that address until the full LSL is replaced.

5. *Control and Responsibility:* The revised LCR should require PWSs to clearly state how the PWS defines ownership of LSLs, who has what financial responsibility for the replacement, what the legal basis is for that determination and any financial assistance programs that may be available.

6. *Planning and Financing Options:* EPA should provide a template and guidance for planning LSL replacement programs, including reference to options to assist customers replace their portion of lead service lines. Small systems may wish to refer to a national information source, such as one provided by EPA; large systems may wish to tailor such information to their circumstances. (See section 4 for further detail.)

7. *Operations and Customer Engagement:* EPA also should provide guidance on PWS policies and procedures for how to engage customers in full lead service line replacement and to inform them on appropriate risk reduction measures. PWSs should adopt templates provided in guidance by EPA or, for larger systems, their own standard operating procedures (SOPs) and make them available to their customers and the primacy agency for:

   a) planned capital projects by the PWS that would require:
      - Prior notification (e.g., 45 days prior to planned main replacement or repair) - Contact letter to affected households likely to have lead service lines, providing information about lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.

- Reminder of flushing post LSLR (e.g., 48 hours prior to actual field work affecting structure) -- Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

b) emergency main and service line repairs by the PWS that would define how to manage potential disturbance to LSLs safely:
   - Direction to information on lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
   - Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

c) flushing of service lines after lead service line replacement:
   - Flush outside hose bib or similarly located spigot close to the meter
   - Initial flush followed by house flush by homeowner or plumber using multiple taps to maximize water velocity
   - Information on proper use of filters when lead levels might be high

d) Requiring PWSs to inform other utilities (e.g. power, cable) whose work might affect water service lines or water mains, both proactively and at "mark out" for specific projects, about how to manage potential disturbances safely and about information to provide residents of affected homes about potential risks and risk mitigation measures. Those other utilities would have the responsibility to alert residents.

8. Community and NTNC water systems (schools, hospitals, churches, jails, etc.) who own the system and control the entire distribution system should replace LSL's as soon as practical, at a timetable to be determined by EPA. This requirement would not apply to community systems where the majority of the connections are individual residential connections (such as mobile home parks and HOA's) where there may be complications due to property ownership of the residence.

The LCRWG discussed and agreed that EPA guidance should encourage PWSs to make every effort to ensure that LSL replacement provides equal protection to low income customers (or rental units with low income residents), people of color and others protected by civil rights law and policy. Environmental justice and civil rights considerations are particularly important in those jurisdictions where the PWS requires the property owner to pay a share of the costs of removing the LSL. Making environmental justice a priority can be achieved through creative financing programs for low-income customers and setting priorities for which neighborhoods are targeted first for LSLR to ensure equal treatment of low income neighborhoods.

The LCRWG also discussed but did not agree that the definition of control as ownership should be changed in the revised LCR. In the current LCR, when a system exceeds the LAL, EPA requires water systems to replace only that portion of the LSL that it owns. This is based on EPA's current interpretation of the term "control" in the definition of public water system as limited to ownership. Some members of the LCRWG urged that the current definition of control as "ownership" should be replaced with a requirement that PWSs must replace the entire LSL, where they have the authority to "replace, repair, or maintain" the line or where they have other forms of authority over the LSL. However, the LCRWG also recognized that some utilities are prevented by law from spending public funds on private property and that gaining physical access to private property poses significant legal issues when a property owner objects.

The LCRWG does agree that the revised LCR should require PWSs to inform customers about the scope of their responsibility with regard to LSL replacement and the legal basis for that decision.

3.1.3 LSL Compliance

3.1.3.a LSL Replacement Compliance

Recordkeeping:
- Inventory of LSLs
- Customer refusals to participate in full LSL replacement

Reporting: At the end of each three year period, each PWS must provide to the primacy agency:
- Certification of the outreach and other efforts implemented (see Table 2 for initial examples);
- Report on the change in the number of LSLs removed from the inventory with better information;
- Report on the number of full LSLs replaced; and
- Report on locations where the utility side LSL was replaced, but the homeowner did not replace the private portion

Violations:
- Failure to conduct required outreach;
- Failure to step up intensity of efforts if 3-year LSL replacement target has not been met;
- Failure to provide on-going outreach to new customers and to follow up (at least every 3 years) with customers at locations with full or partial LSL who do not respond or chose not to participate in the LSL replacement program;
- Outreach materials do not meet the content requirements of the rule

3.1.3.b Operations and Customer Engagement Compliance

PWS must maintain records of who was notified, when notice was given, and content of notice for each capital project. (for 7a and 7b)

Violations:
- Lack of timely notice to customer that LSL removal is scheduled
- Notice materials do not meet rule content requirements

PWS also must develop SOP, and maintain records that it was provided to all utilities conducting activities which may impact LSL (for 7d)

Violation:
- PWS has not developed an SOP (or adopted an SOP template available on the National Clearinghouse) or not provided it to other utilities

3.2 Develop Stronger Public Education Requirements and Programs for Lead and LSLs

Given the public's role in the shared responsibility nature of the LCR, notifying and educating the public about lead in drinking water is important for risk reduction. Public education about the risks of lead in drinking water also is important regardless of whether LSLs are present, since lead can be present in other

premise plumbing materials. Moreover, targeted outreach and, possibly, other efforts are a key to the success of LSL removal programs. The current LCR does not adequately focus on creating on-going opportunities to educate customers on the risks of LSLs or on opportunities to replace them, especially when action is most likely, e.g. at the sale of a home.

The objectives of public education programs should include consumer understanding of: 1) the risks of lead in drinking water; 2) the likelihood that the water in one's home may contain lead; 3) the LCR as a "shared responsibility" rule; and 4) the availability of additional resources that consumers can use to better minimize their exposure to lead.

Although the LCRWG was briefed on and has experience with public education requirements and practices, it does not include members whose specific area of expertise is consumer-centered risk communication. Thus, the LCRWG generally recommends that public education programs for lead should move away from past practices of one-way communication from "experts" to the "public" toward newer concepts of risk communication that involve sustained, multiple, two-way channels of ongoing communication and partnership with the public.[5] EPA should consult with those with such expertise about the outreach and communication recommendations in this report, and encourage and apply best practices in effective ways to communicate with the public.

Communication in languages appropriate to the demographics of the community, in clear terms understandable by the public, and with engaging, reader-friendly graphics, photos, and video all help achieve greater understanding. Outreach programs and materials can be improved by involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies. This information can and should be conveyed in different ways and through different communication channels, tailored to the specific circumstances.

Thus, with these and other considerations in mind, the LCRWG recommends that EPA, in consultation with the aforementioned stakeholders and drawing on principles of consumer-centered risk communication:

- Establish an easily accessible, national clearinghouse of information about lead in drinking water to serve the needs of the public and of public water systems (section 3.2.1).
- Require information be sent to all new customers on the potential risks of lead in drinking water (section 3.2.2)
- Revise the current CCR language to address lead service lines and update the health statements (section 3.2.3).Add requirements for targeted outreach to customers with lead service lines (section 3.1.1).

[5] Resources include: 1) EPA's "Risk Communication in Action" (http://nepis.epa.gov/Adobe/PDF/60000I2U.pdf) ; 2) EPA's "7 Cardinal Rules of Risk Communication" (http://www.wvdhhr.org/bphtraining/courses/cdcynergy/content/activeinformation/resources/epa_seven_cardinal_rules.pdf); and 3) Education & Communication WG Report 2010; National Conversation on Public Health and Chemical Exposures (http://www.resolv.org/site-nationalconversation/files/2011/02/Education_and_Communication_Final_Report.pdf)

- Strengthen requirements for public access to information about lead service lines, tap monitoring results, and other relevant information (section 3.2.4).
- Expand the current requirements for outreach to caregivers/health care providers of vulnerable populations (section 3.2.5)

As part of EPA's consultation with the aforementioned communication experts and stakeholders, the LCRWG recommends that EPA include consultation about methods that would increase public awareness of and motivation to learn about the effects of lead in drinking water and the benefits of removing these materials and/or taking regular precautions when cooking or drinking, regardless of whether LSLs are present or there has been a lead AL exceedance. Consistent with this advice, EPA also should take small systems into account and consider whether such methods should be included in guidance or in revisions to the LCR.

3.2.1 National Lead in Drinking Water Clearinghouse

The LCRWG recommends that EPA take the lead, working with other partners to establish a national, accessible information clearinghouse. The LCRWG suggests that this information clearinghouse include a website, that the materials on the web site be accessible for distribution through the Safe Drinking Water Hotline for those who may not have internet access, and that EPA investigate and apply newer communication technologies and ideas for interactive or other innovative means of communication with the public about lead in drinking water (e.g. social media methods and outreach programs).

The clearinghouse should include information in multiple languages, in clear terms understandable by the public, and should include engaging, reader-friendly graphics, photos, and video. EPA is encouraged to include the design of the clearinghouse in its consultation with people with diverse, and consumer-oriented expertise and perspectives described above.

Such a clearinghouse would be intended for use by the general public, PWS's, public health agencies, and health professionals. It should include:

- information and educational materials for the public that the public could access directly and that PWSs could use to meet many of the public education requirements of the LCR.
- guidance and templates, particularly for small systems, on SOPs for compliance with the LCR (e.g. templates for communicating lead monitoring results to individual customers, templates for explaining to customers how to obtain information on whether their service line could be lead, templates for standard operating procedures related to the LSL replacement program recommendations above, etc).
- Principles and guidelines for best practices in developing the content of the public education materials.
- Case examples of how communities have been successful in lead inventory updates and removal programs, information about funding sources, model ordinances or other types of authorities PWSs have to enable them to implement full LSL replacements, and contacts to other relevant agencies.

Further, EPA should consider best practices in methods for achieving greater public awareness of the clearinghouse so that it reaches as many people as possible.

The web site should include the following information:

Health risks

- Clear and prominent statement that no level of lead in drinking water is safe for human consumption and that a short-term exposure to a young child can result in permanent harm to the brain if the levels are high enough.
- Clear and distinct language on the health risks of consuming lead in drinking water
- Identification of the most vulnerable populations
- Importance of drinking water plumbing as a lead source
- How to have blood lead levels (BLLs) checked and limitations of testing
- How to have water tested and limitations of testing
- List of labs for testing water other than the utility and what to ask for in terms of number and size of bottles, diameter of mouth of bottles, analysis that measures lead particles, etc.

Forms of lead in water and health risk implications

- Soluble
- Particulate
- Unpredictability of lead release

Sources of lead in drinking water

- LSLs
- Other lead-bearing plumbing
- Scale on internal plumbing that can be a source of lead from present or past LSLs

Identification of service line material

- How to recognize a pipe that is made of lead (and when not to check due to age of home)
- What to do about galvanized pipe and why it is a potential source of lead

For homes with LSL

- LSL ownership
- Difference between full and partial lead service line replacement (physically and in terms of health risks)
- Benefits to full LSL replacement
- Actions to take if you have a partially replaced LSL
- Available methods for LSL removal
- Opportunities for removal, approximate cost, and financing options
- Overall benefits to the community of removing LSLs fully (lower treatment costs, better community health, environmental, etc.)
- Where applicable, requirements for notification during real estate transfer or new rental

Health-protective actions

- Precautionary water-use practices
- Role of filters and proper maintenance of them if they are used
- Replacement of leaded plumbing with lead-free plumbing

Additional information

- How to contact your utility and request a LSL inspection and/or water test
- Where applicable, reference to utility-specific website with local lead-related documents and data (e.g. Consumer Confidence Reports (CCRs), sampling protocol used for LCR compliance, lead-in-water test results, etc.)

- What you need to know about lead in water in schools and day care centers (it is not regulated, and link to national website that provides more information)
- Reference to a national website that provides a video version of basic educational information, including information on how the LCR works (with minority language versions)
- Other standard operating procedures, model ordinances, or templates for compliance with the revised LCR
- Where to get more information on drinking water, on lead in water, and on lead in general

3.2.2 Outreach to New Customers

The LCRWG recommends that a revised LCR require PWSs to provide information to all[6] new customers in a letter or via other direct means on the potential risks of lead in drinking water.

The outreach materials should include information about the potential for lead from plumbing materials to contaminate drinking water even when a PWS meets the LCR LAL, to contaminate drinking water in homes with and without LSLs, and to pose chronic and acute health risks to vulnerable populations. The specific information to be covered in those materials could be included in the consultation with the diverse group of experts as described in the introduction to Section 3.2 above and in Section 4 below. Although the LCRWG defers to such a group, it suggests that at a minimum the following topics be covered:

1. Information about lead in drinking water (its sources, variable and erratic release, and wide range of lead concentrations)
2. Information about the health effects of lead in drinking water (including chronic and acute health risks)
3. Information about the LCR's shared responsibility regime
4. Actions the PWS is taking to minimize lead in drinking water
    - PWSs with LSLs would mention their proactive LSL replacement program
5. Steps consumers can take to reduce exposure to lead in drinking water
    - In addition to a list of actions like the ones mentioned in the current Rule, PWSs with LSLs would spell out how consumers in homes with a LSL can participate in their proactive LSL replacement program
6. Phone numbers and online links for additional information (including a link to EPA's online National Clearinghouse)

The outreach to new customers should be delivered within 30 days or with the first bill.

3.2.3 Revise the Current CCR Language

The CCR is a necessary but not sufficient source of information for the public. It can provide general information, but is not designed to be frequent or detailed enough for all public education purposes.

All community water systems (CWSs) should continue to include a statement about lead in their CCR. There may be circumstances (e.g. a subdivision built entirely after January 2014 when "lead-free" requirements came into effect), where a CWS can demonstrate that there are no lead-bearing materials in contact with drinking water. EPA may want to consider allowing the primacy agency to waive this CCR language requirement if an entire CWS can meet this criterion.

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[6] EPA may wish to consider circumstances under which exceptions might be applicable.

The LCRWG recommends that the CCR language should be strengthened to include:

- Public health statements updated to reflect current understandings that there is no safe level of lead and a summary of the health effects, that this risk pertains to everyone, and that some individuals are particularly vulnerable;
- A link to the national clearinghouse should be added to the CCR for all CWSs;
- Recognition that a CWS's compliance with federal regulations does not guarantee what level of lead (lower or higher) might be found at the tap in a particular home; and
- The message that customers play an important role in protecting themselves from exposure to lead.

In addition, the work group recommends that PWSs where full or partial lead service lines exist (or are presumed to exist until an inventory demonstrates otherwise) also add information about what a lead service line is and how to contact the utility for information about how to find out if you have one and why you should replace it.

Further, the LCRWG recommends that the following redraft of the CCR be considered as a starting point for incorporating the elements listed above, to be reviewed by the diverse group of experts that the LCRWG suggests EPA consult .

> ***Important Information from EPA about Lead*** *If lead is present in your drinking water, it ~~elevated levels of~~ can cause serious health problems, especially for pregnant women and young children. Lead can affect children's brains and developing nervous systems, causing reduced IQ, learning disabilities and behavioral problems. Lead is also harmful to adults. Lead in drinking water is primarily from materials and components associated with ~~service lines and~~ home plumbing and service lines (the pipe connecting your home to the water main). ~~(System name) is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components.~~ Contact us for information about lead service lines, how to find out if you have one and why you should replace it. [Last sentence for systems with LSLs.]*
>
> *~~When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.~~ Protecting you against exposure to lead is a shared responsibility. Your water utility is required to minimize the corrosivity of the water. However, because every home is different, the amount of lead in your tap water may be lower or higher than the monitoring results for your public water system as a whole. You can take responsibility for identifying and removing lead materials within your home plumbing and taking steps to reduce your family's risk. If you have lead service lines or lead-bearing materials in your home, ~~are concerned about lead in your water,~~ you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at 1-800-426-4791 or www.epa.gov/safewater/lead. [Insert new national web site link]*

3.2.4 Strengthen Requirements for Public Access to Information

The LCRWG supports the public's right to know about the quality of their water and considered various options to increase the public's access to data related to lead and copper.

Under the current rule, the PWS is only required to make publicly available through the Consumer Confidence Report (CCR) that the "90th percentile value of the most recent round of sampling and the number of sampling sites exceeding the action level." 40 CFR 141.153. In many jurisdictions, a

concerned consumer may be able to obtain or view a redacted version of the complete sampling data set but this approach is time-consuming and burdensome on the PWS (or the state) and the community. EPA receives only a summary of the sampling results.

As the LCRWG evaluated different approaches, we kept in mind EPA's Office of Enforcement and Compliance Assurance (OECA) five principles for highly effective regulations and that OECA is working with regulatory programs to evaluate new and revised rules against these principles. Principle 4 calls for rules to "leverage accountability and transparency by providing the government and the public with real-time access to quality information on regulated entities" emissions, discharges and key compliance activities and outcomes." OECA identified two tools to accomplish this:

- Electronic reporting to the government.
- Public accountability via websites, paper/electronic mailings, and other ways to provide the public and stakeholders (e.g., customers, ratepayers) with compliance information.

The LCRWG encourages EPA to use the SDWIS-Prime data system[7] that is under development to meet the first provision of the above goal. Electronic reporting from utilities to a centralized data system would allow the public to access data from the State or EPA in a coordinated manner and allow for consistent access to all water quality data, not just data for lead and copper.

Until such time as the new data system is in place, though, the LCRWG believes that water systems should increase the availability of data to the public. This would include:

- The number of samples over the Household Action Level (described in Section 3.5 below) in the last monitoring period, the highest level found during the last monitoring period, the median levels, and the most recent 90th percentile level compared to the "system action level" (renamed from the current action level).
- Requiring water systems to include WQP-related information on their webpage, or in the CCR or some equally accessible manner (e.g., CCT treatment, approved WQP ranges, WQP results from the last monitoring period)
- Encouraging water systems to post additional information on their webpages such as:
    - Public education materials (and link to National Clearinghouse).
    - Sampling protocols the water system provides to customers to use when collecting lead samples and any variations from EPA recommendations.
    - Individual sampling results (with appropriate privacy provisions such as address redaction).
    - Inventory (such as a map) of confirmed and presumed lead service lines.

Where a community has lead service lines, EPA should require PWSs provide a public statement of lead service line ownership and the legal basis of said determination. (See section 3.1.2, point 5 *"Control and Responsibility."*)

[7] SDWIS is a database for storage about drinking water systems. The federal version (SDWIS/FED) stores the information EPA needs to monitor approximately 156,000 public water systems. The state version (SDWIS/STATE) is a database designed to help states run their drinking water programs. SDWIS-Prime is an upcoming version of this program. The website for SDWIS is located here:
http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/index.cfm
SDWIS Reports:
http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/howtoaccessdata.cfm

3.2.5 Routine Outreach to Caregivers/Health Care Providers of Vulnerable Populations

The LCRWG recommends that a revised LCR encourage PWSs to cooperate in locally appropriate public education programs targeted at caregivers and health providers of the populations most vulnerable to lead in drinking water (i.e., pregnant women, infants, young children, and children with elevated BLLs). The intent of such outreach is to raise awareness among caregivers and health providers about the health risks of lead in drinking water, easy steps to prevent exposure, and the availability of EPA's online National Clearinghouse for further information. It is expected that public education messaging in service areas with LSLs will differ from public education messaging in service areas without such lines.

In conducting outreach to caregivers and health care providers it is important that the message be provided by an organization or individual that carries credibility with those audiences. The LCRWG suggests the way to best ensure that caregivers and health providers hear and respond appropriately to information about lead and drinking water is for water suppliers to participate in joint communication efforts, lead by state health departments, state lead poisoning prevention agencies, and state drinking water primacy agencies. This outreach should be targeted to individuals, organizations and facilities likely to be visited by the vulnerable populations of pregnant women, infants, and young children, such as:

1. local public health agencies;
2. public and private pre-schools, schools;
3. Women Infants and Children (WIC) and Head Start programs;
4. public and private hospitals and medical clinics;
5. pediatricians, obstetricians-gynecologists, and midwives;
6. family planning clinics;
7. local welfare agencies; or
8. licensed childcare centers.

1. The outreach efforts should make use of the information provided in the clearinghouse

Examples of communication vehicles that might be suggested in guidance materials include:

- Development and routine delivery of a joint communication from the PWS (or a group of PWSs) and the City/State to:
    - Health providers (e.g., OBGYNs, pediatricians, midwives)
    - Childhood lead poisoning prevention professionals/organizations
    - Professionals at licensed daycare centers and schools
    - Listservs/organizations for pregnant women/parents of infants (e.g., local listservs, environmental health groups, La Leche League, etc.)
- Delivery of educational materials during any water-related work at customer homes
- When lead-in-water levels at individual homes test above the HAL, delivery of information to a) the residents at the home and b) City/State health departments. These materials ought to cover information prescribed in the current LCR for public outreach during a LAL exceedance as well as:
    - The lead level detected at the specific home
    - What this level means in terms of health risk to vulnerable individuals
    - If the PWS determines that the home has a LSL, information about how to participate in the PWS's proactive, full LSL replacement program.

The LCRWG also recommends that EPA, informed by the advice of the diverse group of experts described above and working with CDC, HHS and HUD, develop guidance (and make it available through the National Clearinghouse) on how to develop and deliver effective communication efforts to caregivers and health care providers focusing on ways those individuals and groups can reach pregnant women, parents of infants and young children and those who care for them. The audience for those materials would be state primacy agencies, state or local health departments, and state or local lead poisoning prevention agencies, as well as PWSs.

To support PWSs in the development of feasible, locally appropriate, and successful public outreach programs targeting vulnerable groups on a routine basis, the LCRWG recommends the following: that the diverse group of experts EPA may convene for the development of consumer-centered public education messaging and materials (see introduction to Section 3.2), also develop guidelines and best practices that PWSs can use to create proactive risk communication programs. Echoing extant principles and understandings of effective risk communication,[8] we imagine such programs to involve robust collaboration between PWSs, many of the local public health agencies and organizations listed above, as well as local childhood lead poisoning prevention groups (State-funded and grassroots), environmental health organizations, and key community leaders (e.g., advisory neighborhood commissioners).

Education of public health and health care providers on lead and water issues

The LCRWG had extensive discussions about the frustration that members of the group had that many in the public health community minimized the risk of lead exposure from drinking water, placed a lower priority on actions to reduce that risk, and frequently provided incomplete or conflicting information to members of the public or patients. This made and continues to make the work of water professionals in motivating appropriate action by customers more difficult. Those in the health sector are highly regarded, and viewed as knowledgeable about all health related topics. Customers will look to them for advice and to validate what they hear from their water provider. Efforts by water systems to reach out to their customers must be appropriately re-enforced by those in the health sector if those efforts are to be successful.

The LCRWG recommends that EPA, CDC, HHS and HUD conduct training and outreach to local health agencies, medical professionals and local and state lead poisoning prevention agencies on:

1. Information about lead in drinking water (its sources, variable and erratic release, and wide range of lead concentrations)

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[8] Lundgren, R. E. and A. H. McMakin. 2013. *Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks*. Hoboken, NJ: John Wiley & Sons, Inc.
Risk Communication in Action, http://nepis.epa.gov/Adobe/PDF/60000I2U.pdf
Communicating about Lead Service Lines, http://www.awwa.org/Portals/0/files/resources/publicaffairs/pdfs/FINALeadServiceLineCommGuide.pdf
Strategies to Obtain Customer Acceptance of Complete Lead Service Line Replacement, http://www.awwa.org/Portals/0/files/legreg/documents/StrategiesforLSLs.pdf
National Conversation on Public Health and Chemical Exposures: Education and Communication Work Group Report, http://www.utmb.edu/cet/downloads/Natl_Conv_Edu_Comm_WorkGroup%20Report.pdf
Advancing Collaborations for Water-Related Health Risk Communication, http://www.waterrf.org/PublicReportLibrary/91145.pdf.

2. Information about exposures routes of lead in drinking water to different vulnerable populations, including pregnant women, infants and young children
3. Information about lead service lines
4. Information about the LCR's shared responsibility regime between water system and customer
5. Actions that PWSs typically take to minimize lead in drinking water
6. Steps consumers can take to reduce exposure to lead in drinking water, including removal of LSLs
7. Phone numbers and online links for additional information (including a link to EPA's online National Clearinghouse)

The LCRWG also recommends that EPA work with CDC to incorporate in the CDC's website, educational materials, and materials used by CDC-funded childhood lead poisoning prevention programs nationwide, accurate and up-to-date information about lead in drinking water (its sources, variable and erratic release, wide range of lead concentrations, chronic and acute health risks, the LCR's shared responsibility regime, steps to prevent exposure).

3.2.6 Public Education Compliance

3.2.6.a Compliance for New Customer Outreach

Violations:

- Failure to provide information to new customers

3.2.6.b Compliance for CCR

Recordkeeping, reporting and violations: Same as in the current CCR rule, with updated content.

3.2.6.c PE Compliance for Public Access to Information

PWS must provide the public access to information about:

- Number of samples over the Household Action Level, median, 90th percentile, and highest level found in the last monitoring period
- CCT treatment, approved WQP ranges and WQP results from the last monitoring period

Violations:

- Failure to make this information available to the public

3.3 Improve Corrosion Control

Corrosion Control Treatment (CCT) involves the addition of chemicals (e.g. orthophosphates or silicate) to create a barrier between the pipes and the drinking water, or to modify drinking water chemistry (such as pH and hardness) to inhibit the potential for corrosion. The concept is to manage the treatment system to reduce corrosion (and, thus, the release of metals such as lead and copper) from the distribution system and premise plumbing.

Under the current LCR, PWSs serving more than 50,000 people were required to work with their primacy agency (typically the state) from 1994 to 1997 to designate and install optimal corrosion control treatment. Systems serving 50,000 people or less must optimize corrosion control treatment only if the

results of lead and copper tap sample exceed the action levels. A PWS exceeds the lead AL if ten percent or more of the tap samples collected are greater than the 15 ppb action level.

In evaluating CCT choices, a PWS must consider list of assessment parameters; and, as part of the approval of a PWS CCT plan, the state also approves a shorter list of process control parameters applicable to that system to demonstrate that the selected treatment is being properly operated over time. For purposes of this report, the term water quality parameters (WQPs) applies to these latter process control measures. Recommendations concerning WQPs are included in Section 3.4.

Based on the experience with current LCR requirements provided to this work group and shared by work group members, the LCRWG has concluded the following:

- CCT remains an important component of the LCR, in that it is intended to achieve a water quality that minimizes dissolution of lead and copper in water.
- Effective CCT varies based on the specific conditions from system to system. Increased knowledge about CCT since promulgation of the current LCR, if applied today, could lead to improvements in CCT in some systems. Thus, PWSs and their primacy agency should apply the most current science, tailored to the unique circumstances of each system, to the choice of treatment plan and its associated water quality parameters. A variety of factors affect the dissolution of lead in water, including but not limited to pH and alkalinity. Factors other than the stability of designated WQPs can include, among others, the formation/dissolution of protective scales; the presence of manganese, iron, chlorides, sulfates, aluminum and other materials; and temperature. Variations in water quality also can occur within the distribution system. These water quality conditions vary among PWSs, which in turn affect the CCT choices a PWS must make in the context of other regulatory requirements.
- Lead also occurs in different forms in plumbing systems, from soluble to insoluble and particulate in nature. Sources of lead vary from the very common leaded solder and brass fixtures/valves, to LSLs, and to less common lead-lined iron pipe. CCT is more effective in reducing exposure to soluble lead than it is for particulate lead, although CCT that contributes to the formation of certain scales may also provide benefits in reducing exposure to particulates. Thus, while very important, CCT is not the only lead control mechanism that a PWS must have in place. In other words, CCT should not be relied upon by itself to control lead in water. Rather, it should be one of a tool box of other required mechanisms depending on a PWS's particular conditions and lead sources (e.g. LSLs, leaded solder, leaded brass, etc.). These tools are described in other sections of this report and include: LSL replacement (as well as the replacement of other less common sources of lead such as lead-lined iron pipe), current and future use of lead-free materials, stronger public education including targeted public education to vulnerable populations (pregnant women and families with infants and young children), availability of certified POU filters, instructions on how to flush plumbing systems when lead could be disturbed, etc.

3.3.1 Corrosion Control Recommendations

The LCRWG recommends that:

- EPA release a revised CCT guidance manual as soon as possible and update this manual every six years, so that PWSs and primacy agencies can take advantage of improvements in the science;
- EPA provide increased expert assistance on CCT to PWSs and primacy agencies;
- The LCR continue to require re-evaluation of CCT when a PWS makes a change in treatment or source water;

- The LCR continue to require WQP monitoring to ensure that the CCT is achieving the treatment objectives and that EPA consider requiring such monitoring on a more frequent basis with additional guidance on process control methods; and
- Large systems review their existing CCT plan in light of current science in a newly revised guidance manual with their primacy agency to determine whether the WQPs reflect the best available current science. The LCRWG suggests that this review be done every six years following EPA's six year rule review cycle, and subject to there being sufficient science change that EPA updated the guidance manual. EPA should plan to review and refresh Agency guidance every 6 years, subject to significant improvement in the state of knowledge, to allow research to inform rule implementation. In addition, regularly revised guidance would help states and systems stay current with corrosion control science as they respond to problem situations, but more importantly help them anticipate challenges as new water sources and treatments are brought on line, or they contemplate further refinement to corrosion control. Small and medium sized systems should work with their primacy agency to determine whether updates to CCT guidance is applicable to them.

3.3.2 Corrosion Control Compliance

PWS must maintain records that it reviewed new EPA guidance manuals and assessed whether and, if so, what changes to CCT are applicable, based on the current state of the science.

Violations:
- Failure to notify and consult with primacy agency on re-evaluating CCT if the PWS makes a change in treatment or source water
- Failure to review CCT when EPA updates the guidance manual (for large systems)
- Failure to act if state notifies them that they should assess CCT or make adjustments, based on state review of guidance manual (for medium and small systems)

3.4 Modify Monitoring Requirements

Under the current LCR, a PWS is required to conduct monitoring to assess the effectiveness of its corrosion control treatment (CCT) 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. In the Lead and Copper Rule (LCR), water systems must prioritize sample site locations (often residences) within the distribution system which are at a high-risk of elevated lead and/or copper in the water. Selection and use of these elevated lead and copper sites enables a smaller number of sample sites than random or geographic site selection procedures.

Implementation of this approach over time has revealed numerous challenges. Recruitment of customers to take in-home samples can be difficult and costly. Customers are not professional samplers and, thus, may implement the sampling protocols inconsistently. Research on sampling protocols also has shown that sampling results may vary, and not necessarily consistently, based on the configuration and length of lines from the water main to the sampling tap and whether the sample is a first draw or a subsequent sample intended to reflect water that had been in a LSL for some time.

The LCRWG recommends two types of on-going monitoring: 1) a more robust WQP monitoring program to improve process controls for CCT, and 2) voluntary customer initiated tap water sampling coupled with a more robust and targeted public education program to encourage sampling, in part to provide direct

information to consumers that they can use to reduce potential exposures to lead from drinking water in their home and to provide ongoing information to the PWS to identify and correct unanticipated problems.

The LCRWG also recommends that EPA establish criteria for a PWS to transition from the current rule framework into the new rule framework. The LCRWG recommends that the transition includes a condition that a PWS must comply with the requirements of the current LCR until the PWS has achieved three rounds of monitoring results under the lead AL using the current LCR requirements. Results from past rounds of monitoring can be used or new data will be required if prior data are above the AL. At that point, the PWS can define their CCT or WQPs for the new rule as that which was used to achieve this record. The existing lead AL should be redefined as a System Action Level in the new rule wherein it will be used when determining re-optimization, e.g. for use during a review of a new source or treatment, if the state determines that additional utility tap sampling is warranted. In other words, it will provide a baseline target for confirming CCT if lead sampling is chosen as one means by which to determine CCT. PWSs must continue to demonstrate that they are maintaining the WQPs used to establish the transitions. All systems, regardless of their lead AL status, should be required to transition to the new LSL replacement program and public education program requirements of the revised LCR as of the effective date of the new rule.

3.4.1 Water Quality Parameter Monitoring

As noted above, WQP monitoring is distinguished from the more extensive list of parameters that a water system would consider as it evaluates corrosion control technology choices. WQPs for the purpose of this section involve the on-going process control monitoring that demonstrates that the selected treatment is being properly operated over time.

The WQP program recommended below builds on what is in the current rule by recommending:

1) more frequent monitoring than currently required and monitoring that is representative of the distribution system (e.g. at points currently used for DBP monitoring or at a subset of points used for TCR monitoring) to capture currently undetected variability;
2) continuing to tailor WQPs to the individual PWS CCT plan and asking EPA to review and consider adding to the list of WQPs referenced in the LCR, based on EPA's anticipated revision to the CCT guidance manual;
3) that WQP monitoring be periodically revisited based on the advancing science as documented in research reports and disseminated through periodically revised EPA guidance manuals; and
4) that a more rigorous data review process such as control charting and similar process control techniques be used to take advantage of the collected data to improve the consistency of operation, encourage fine-tuning of processes, reduce variability of water quality within the distribution system and detect and manage excursions.

In addition, these data should be reviewed whenever there is a change in source or treatment (see 4.3 above); and, when a system or state primacy agency sees significant changes in WQP data, it should initiate a "find and fix" process, looking for what changed and why, and requiring the PWS make any needed adjustments or corrections. This provides one type of reality check and correction not explicitly in the current LCR.

In addition, the LCRWG recommends that systems which are not currently practicing CCT under the LCR but have been under the lead action level by virtue of either naturally non-aggressive source water or by virtue of other aspects of treatment in use, be required to conduct a WQP monitoring program to

continue to demonstrate that the characteristics which caused them to be non-corrosive are continuing to be in place.

3.4.2 Tap Sampling for Lead

The LCRWG also recommends that a voluntary customer-initiated sampling program based on the more robust and targeted public education efforts being recommended elsewhere in this report be substituted for the current LCR tap sampling requirements. .

The results of the voluntary tap sampling program will be used for three separate purposes:

- informing and empowering individual households to take action to reduce risk,
- reporting to health officials when monitoring results exceed a "household action level" (see section 3.5) and
- ongoing information to the utility to assess effectiveness of CCT.

Information for Households

Data from customer-initiated sampling will be valuable in informing and empowering individual households and thus provide greater customer service. All data provided to customers would need to include appropriate information about the variability of lead levels, that a single sample does not represent all water quality, and that levels at a particular tap at a particular time might be higher or lower. The transmittal should also provide appropriate information about the risks of lead exposure, sensitive populations, and actions the consumer can take to minimize risk.

This type of sampling is currently discouraged by the current rule because water systems are often concerned that "complaint" or "customer " samples would be included into the required 90th percentile calculation with potential mandatory response actions if it exceeded the action level. This resulted in system not offering sampling or having the samples be analyzed through a private lab (and therefore the data would not be available for any utility management or regulatory purpose). Currently, PWSs are mandated to return to the same locations which, while it may have value for other reasons, means that many other households do not get the opportunity to understand their lead exposure. Voluntary customer-initiated sampling can also capture data from multi-family residences, which is not included in the mandatory LCR sampling in most cases. A new approach could achieve greater customer service and more data to understand and manage lead corrosion.

Outreach to encourage customers to sample will likely involve many different customer contact opportunities including the CCR, outreach related to having a LSL, outreach related to construction contracts, new customer contact, community meetings, other educational outreach efforts, and whenever a customer contacts the CWS for a water quality question or complaint.

Customers should be given the opportunity to determine the type of information they are interested in, thus should be offered a menu of sampling protocols, e,g. a random daytime sample to determine typical exposure levels, first draw to determine the effects of a brass faucet, or a timed or temperature determined sample from within a service line. The National Clearinghouse should include templates with instructions for each type of sample.

Information for Public Health Officials

Data from customer samples which exceeded the "household action level" recommended in section 3.5, would be required to be forwarded to health officials. While LCR tap water results are currently provided to the collecting household, the LCR does not require any <u>action</u> for individual high samples, and there is

no mandate to refer to health authorities. While the LCR cannot guarantee actions by health departments, this recommendation provides direct health intervention in those cases where sampling indicates high lead levels.

Information for Assessing the Effectiveness of CCT

The third use of the customer tap sampling data is to provide on-going information to the utility of potential changes in the effectiveness of CCT. Under the current rule, most systems are sampling for one four-month period every three years. Any changes or variability in lead levels at the tap during the other 32 months of that period are missed. Under this proposal, it is anticipated that there would be a more regular stream of data from more locations, providing information which can be used to understand system performance. The data would be provided to the state primacy agency and presented as time series data to facilitate identifying any changes in the data over time. Small systems might report the data on something as simple as a spreadsheet chart, while larger systems might use more sophisticated analytical methods to understand and use the data.

Unexpected or unexplained changes in the tap sampling data can be used in a "find and fix" approach to identify and respond to potential problems. This could be system initiated or in response to periodic review of the system data by the primacy agency, such as during a sanitary survey. This provides a reality check on whether something unexpected is happening within the distribution system, even though consistent treatment was maintained. The more robust (in both temporal and geographic distribution) of the customer sample data set provides a more powerful check on treatment than the current episodic sampling does.

Specifically the LCRWG recommends that the revised rule require that:

- any customer sampling data be reported to the state on a routine basis and include which of the menu of sampling protocols referenced above was used;
- data be provided as soon as possible and no later than within 30 days to the customer and, if over the household action level, to the health department (as discussed above and in section 3.5);
- the PWS maintain the data set for analysis and review, taking type and location of each sample into consideration, to identify trends and changes in the data;
- the data be available for public review as described in section 3.2.4;
- the PWS and the state review the data and trend analysis during sanitary surveys;
- annually, at the discretion of the primacy agency, the PWS provide the primacy agency with a data summary report of the three most recent years of all tap sampling data, the specific details of which should be determined by EPA;
- if the three most recent years of customer sampling data show that the 90th percentile (running three-year calculation) is above the System Action Level, then the PWS must analyze any changes or trends in the data to evaluate whether they are based on system-wide, local , or household-based conditions, and provide the report and analysis to the state for their review and determination if additional analysis, re-evaluation of CCT, or other actions such as household-based actions (LSL removal, education about lead-free faucets and flushing after non-use of water, etc.) are appropriate.
- if the system makes any source or treatment changes, the PWS and state should use the customer sampling data in the consultation, review and approval by the State currently required by the LCR.

The LCRWG also recommends that EPA provide guidance to states and PWSs on additional forms and types of data analyses which can be conducted on sampling data to provide more detailed understanding

of trends and to support system decision making on customer actions, treatment evaluations or development of system plans and priorities for LSL replacement programs.

It seems appropriate to include some sort of floor to the number of customer samples. Some members of the group suggested that systems should be required to collect no fewer samples in a three year period than they would under the current three-year reduced monitoring requirement.

When a system changes its source or treatment, and is required to consult with the state, the state primacy agency also may choose to require additional one-time monitoring to evaluate those changes if the degree of the change warrants.

Some members suggested that some small systems might want the opportunity to maintain the current home tap water monitoring program. The revised LCR should allow this, while not discouraging customer sampling.

3.4.3 Sample Invalidation Criteria

Under the existing regulation (141.86 (f)(1)), "The State may invalidate a lead or copper tap water sample if at least one of the following conditions is met.

(i) The laboratory establishes that improper sample analysis caused erroneous results.
(ii) The State determines that the sample was taken from a site that did not meet the site selection criteria of this section.
(iii) The sample container was damaged in transit.
(iv) There is substantial reason to believe that the sample was subject to tampering."

These are all good and necessary reasons for invalidating a sample and should be retained, but because this list is limited, samples must be accepted that are obvious "outliers" and don't represent the water that is normally consumed and should not be used as a basis for treatment changes or public education. This is especially true for small systems where the limited number of samples required means that a single, unusually high, value can cause the Action Level to be exceeded. This could lead to installation of expensive treatment when treatment is not needed or adequate corrosion control is already being provided. While probably not as frequent, non-representative samples could also cause water systems to be below the action level when treatment changes really are needed. Good invalidation criteria can help states address both problems.

The purpose of the invalidation is to make sure that decisions are based on the most representative set of samples possible and to do so through a process that provides adequate information to make good invalidation decisions and assures documentation of the reasoning behind the invalidation.

The following is a proposal from states that will serve those two functions.

States believe that the essential criteria for invalidation are already well stated in the Revised LCR Monitoring and Reporting Guidance (EPA 816-R-10-004, March 2010) or the October 2006 memorandum on Management of Aerators During Collection of Tap Samples to Comply with the Lead and Copper Rule. The LCRWG recommends that EPA take the following into account when revising the proposed rule and expand the invalidation criteria accordingly:

- Make sure the sample is taken at a tap that is used regularly, and not an abandoned or infrequently used tap."
- "If first-draw samples are collected at single-family residences, the sample must always be drawn from the cold-water kitchen tap or bathroom tap."

- "If first-draw samples are collected from buildings other than single-family homes, the sample must always be drawn from an interior tap from which water is typically taken for consumption."
- "Public water systems should not recommend that customers remove or clean aerators prior to or during the collection of tap samples for lead."

3.4.4. Monitoring Compliance

PWS must monitor and report based on water quality parameters and schedule set by state primacy agency, and use the data for on-going treatment process control (3.4.1)

Violations:
- Failure to monitor as per schedule
- Failure to maintain data, and use in process monitoring (to be evaluated by state during sanitary survey inspections or as state primacy agency requests)
- Failure to report data to state
- Monitoring results outside the WQP range established in the PWSs CCT plan along lines similar to current rule requirements

PWS also must include an offer to customers in all LCR related outreach to collect a sample, including in all LSL outreach efforts. PWS must also:
- collect sufficient number of samples, either by customer request or utility initiated sampling, i.e. no fewer samples in a three year period than under the current three-year reduced monitoring requirement, assuming the PWS qualifies for such reduced monitoring;
- promptly report the data to the customer, the state and local PH (if above health action level); and
- use the data as part of on-going evaluation of CCT performance, monitoring for changes in lead levels at the tap over time, geographic trends in levels, and interaction with distribution system water quality.

Violations:
- Failure to offer to sample
- Failure to collect minimum number of required samples within 3-year window
- Failure to report data to:
  - Household
  - State
  - Local public health agency (if above household action level) no later than 30 days after the result was received
- Failure to provide rule-required information in sampling offer materials, or in household reporting of the data
- Failure to use household tap sampling data in on-going evaluation of CCT and maintain record of having done so, (as determined by state during sanitary survey inspections or as state primacy agency requests)

3.5 Establish a Household Action Level

The current lead action level is based on the 90th percentile of the collected samples. Without a maximum limit, some users may be exposed to levels of lead in the drinking water that presents a potentially significant health threat, especially to children, without exceeding the action level.[9] If the levels are high enough and state and local authorities do not act, EPA could determine that the levels pose "an imminent and substantial endangerment to the health of persons" pursuant to section 1431 of the Safe Drinking Water Act. (40 USC 300i)

3.5.1 Household Action Level Recommendations

To avoid the possible need to invoke section 1431 of the SDWA, the LCRWG recommends that EPA establish in a revised rule a "household action level" and require the PWS to notify the local health department and state drinking water authority of sample results over that level. The requirement would be triggered by any sample results that the PWS receives from a user or from its own monitoring. However, the PWS would not be required to make the notification until it has investigated the sample in a timely manner to eliminate sampling or assay errors.

The existing rule already requires the PWS to notify residents of the results of water system conducted lead sampling. We would anticipate that the PWS would alert the resident to possibility that the health department may be notified when the sample was taken or the resident provided the PWS with the sample results. While this notice may have the unintended consequence of discouraging some customers from testing, it is important for the customer to make an informed choice.

In response to the notification, the PWS and the health department would consider the situation and take action that they deem appropriate (e.g., testing children's blood, recommending a filter, discussing lead service line replacement with the resident or landlord, advising grandparents about risk to visiting children, or continuing to monitor the situation). We anticipate that the health department be the lead agency, and that the rule would not prescribe actions other than notice as the situations are too diverse and complicated for prescription actions. The LCRWG encourages EPA to work with the Centers for Disease Control and Prevention on recommended approaches and make this information available through the clearinghouse discussed in section 4.2.

This requirement would be somewhat similar to the regulatory approach taken by the Department of Housing and Urban Development which mandates that public housing authorities notify the local health department within five days when it receives information from any source that a child of less than six years of age living in an assisted dwelling unit may have an environmental intervention blood lead level. (24 CFR 35.1225)

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[9] The LCRWG discussed the relationship between the household action level and the current lead AL (to be renamed the system action level). These levels have two distinct purposes. The LCRWG assumed during its discussions that the household action level would be significantly greater than the system action level. It recognized, therefore that, depending on what level is set, the household action level may have impacts on other recommendations in this report.

We recommend that EPA set the household action level based on the amount it would take for an infant to have a blood lead level greater than five micrograms per deciliter (µg/dL) based on consumption by an average, healthy infant of infant formula made with water. When a child's blood lead level exceeds five µg/dL, the Centers for Disease Control and Prevention (CDC) recommends that laboratories and health care providers notify local and state health departments and that action be taken to identify and prevent further exposure.[10]

3.5.2 Household Action Level Compliance

If household sample exceeds the household action level, PWS must promptly notify the household and the local public health agency; certify that this has been done, and maintain records of having done so.

Violations:

- Failure to report data no later than 30 days after the result was received, to
  - Household
  - Local public health agency
- Failure to certify to state that data was reported to the household and to the local public health agency within 30 days
- Failure to maintain records of correspondence between PWS and the local public health agency,

3.6 Establish Separate Monitoring Requirements for Copper

The current LCR does not deal effectively with copper. Generally speaking, the current rule focuses on the health benefits associated with lead risk reduction, with the result that the currently required in-home sampling is often done in locations with old copper that has passivated. Thus, the possibility may be missed that a system's water chemistry could result in copper releases. Further, the current rule does not require public education for copper, which can have broad benefits.

The LCRWG has concluded that the regulatory approach should separate lead and copper risk management, refocusing attention to where there may be a problem with copper without increasing the burden on systems where there is not a problem. This can be achieved in a cost effective manner by targeting copper monitoring requirements to those PWSs where there may be exposures.[11]

Elevated exposures to copper generally result from new copper plumbing[12] where water chemistry is aggressive to copper. It is technically possible to identify water chemistries that are aggressive versus not aggressive to copper. Thus, the LCRWG recommends that the requirements for copper monitoring focus first on sampling for basic finished water quality parameters such as pH, alkalinity, and orthophosphate in a way that is representative of the distribution system to identify waters that are aggressive to copper. Systems that can demonstrate that their finished waters are not aggressive to copper or that their

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[10] http://www.cdc.gov/nceh/lead/ACCLPP/blood_lead_levels.htm

[11] The LCRWG recommends this approach, assuming EPA determines that the health benefits of regulating copper justify the costs. A full health risk assessment for copper was beyond the scope of the LCRWG's charge, however; and, thus, EPA's analysis of whether benefits justify the costs may have implications for these recommendations.

[12] New copper is generally understood to be between six months to three years of use.

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distribution systems contain no copper should have no further copper monitoring requirements. This could be written into the rule, rather than require a monitoring "waiver."

3.6.1 Copper Recommendations

Further, the LCRWG recommends that the LCR be revised based on the following concepts:

1. Instead of basing action on the results of routine, in-home copper sampling, actions should be based on the aggressiveness of the water to copper. Systems can determine if their water is aggressive to copper by doing WQP monitoring in the distribution system. All PWSs should be assumed to have water that is aggressive to copper unless they demonstrate that it isn't.

2. EPA should develop criteria to define water that is not aggressive to copper for the purpose of establishing whether a system falls into that category (or "bin") for the purposes of the LCR. EPA should consider the accuracy and potential variability of pH and alkalinity monitoring as well as corrosivity to copper in establishing pH and alkalinity ranges. The criteria also should include consideration of passivation time. Examples of bins (for verification by EPA) would be:

    a. if alkalinity is < 35 pH must be > 7.0 (no upper pH limit)
    b. if alkalinity is 36 to 100, pH must be > 7.2
    c. if alkalinity is 101 to 150 , pH must be > 7.5
    d. if alkalinity is 151-250 , pH must be > 8

If orthophosphate is used, examples of bins would be:

    a. if alkalinity <150, PO4 must be >1 mg/L
    b. if alkalinity is 150 to 200, PO4 must be > 2 mg/L
    c. if alkalinity is 200 to 240, PO4 must be > 3 mg/L
    d. if alkalinity is greater than 240, PO4 must be > 3.3 mg/L

3. PWSs can choose one of several approaches to demonstrate that their water is not aggressive to copper:

    a. Conduct water quality parameter monitoring to assess whether their water meets the definition established by EPA.

    b. Conduct a one-time evaluation with copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL). EPA may want to consider:

        i. Limited number of sample sites needed given copper chemistry

        ii. Provision for sample invalidation based on site-specific conditions such as biologically-induced corrosion.

    c. Conduct a pipe loop study to demonstrate the water chemistry is non-aggressive

    d. Change water chemistry to within the range established for non-aggressive water quality

4. PWSs with water **classified as non-aggressive to copper** must continue to demonstrate that the water is non-aggressive. PWS's can choose to:

    a. Maintain those WQPs that demonstrate it maintains non-aggressive water under (2) above, or

b. Conduct copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL)

PWSs that are not able to maintain their WQPs must implement a public education program as described in the next section.

5. PWS's with water **classified as aggressive to copper** must initiate and maintain a public education program. The public education program must either provide:

   a. Information to all new homes (new construction or change of service) upon initiation of new service

      AND

   b.
      i. Information to newly renovated homes at time of renovation

      OR

      ii. Information to all customers on a routine basis

   In addition, in guidance, EPA should encourage PWSs to notify contractors, plumbing suppliers, and plumbers of copper corrosivity and to work with relevant officials and organizations to consider building and plumbing code changes that would prohibit copper piping in new construction if the corrosive water conditions cannot be eliminated. EPA also should provide guidance and/or templates, particularly for small systems, for public education messages and modes of delivery.

6. EPA should consider whether or under what circumstances CCT should be required for a PWS **classified as aggressive to copper** Not all systems with water aggressive to copper necessarily will have homes with new copper, so treatment might not be necessary or perhaps even advisable, particularly for small systems that can control plumbing materials used or for systems in communities that modify their plumbing codes. Passivation time of copper varies considerably, and CCT may not be necessary or advisable when passivation time is short if interim actions to protect public health other than CCT are feasible. In determining when CCT should be required and any associated monitoring requirements, EPA also should take into consideration that a PWS may not have access to information about renovations where new copper has been installed and, even when such information is available, can't control whether the customer will participate in a monitoring program. Setting the correct level and establishing a regulatory approach that triggers CCT only when necessary will require a complex assessment and is beyond the scope of this workgroup.

7. In the revised LCR, systems should continue to be required to notify the primacy agency if they are making any long-term treatment change or addition of a new source. This section of the rule should be made clear that for copper, the system may be required to demonstrate that its finished water continues to be non-aggressive to copper (per 4 above).

8. Additional information needs to be gathered on the current distribution of pH, alkalinity, and phosphate residual among systems nationally to fully understand the implications of this approach.

3.6.2 Copper Compliance

Violations:

- Failure to implement public education, for PWSs that have not demonstrated their water chemistry is not aggressive to copper.
- Failure to maintain a monitoring program representative of the distribution system that demonstrates the system has water chemistry not aggressive to copper.
- Failure to provide notice to and, if required, consultation with the primacy agency, when a PWS makes a significant change in source or treatment (as in the current LCR).
- Failure to implement CCT or other risk reduction actions prior to CCT as determined by the primacy agency.

4 Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water

The LCRWG urges EPA not only to promulgate a revised LCR, but also to play a leadership role in educating, motivating, and supporting the work of other agencies, where EPA does not have the authority to act. The LTR LCR is very important. However, removing lead from drinking water systems and reducing exposure to lead from drinking water in the meantime will require renewed commitment, cooperation and effort by government at all levels and by the general public.

Specific recommendations for action in addition to the LTR LCR include (grouped generally by who might take such actions):

<u>EPA Actions</u>

- EPA working across all offices to take an integrated approach to action and education on lead from all sources (paint, air, site clean–up, etc.), with proper emphasis on lead in drinking water, especially in relation to the populations most vulnerable to this source (pregnant women, infants and young children). For example, OGWDW should coordinate with EPA's lead-based paint program so lead hazards are communicated consistently.
- Work with other federal agencies including HUD in terms of lead programs including but not limited to expanding federal funding from those programs to include lead service line replacement; HUD/DOT in terms of efficiency in possible coordination of lead service line replacement with road projects and other construction projects; and CDC in terms of childhood lead poisoning prevention, screening, and protection programs
- Enhanced cooperation with state, county, and local health departments to promote an integrated approach to childhood lead poisoning screening, prevention, and protection that emphasizes drinking water and its potential as a primary lead source (e.g. infants dependent on reconstituted formula).
- EPA needs to work with agencies at all levels of government to support financial assistance programs for LSL removal. Building costs into a PWS's capital budget planning should also be a consideration.
- EPA should include diverse perspectives in its stakeholder engagement programs, including affected consumers (who should not be required to be members of formal organizations), lead poisoning prevention/clean water advocates, EJ advocates, lead/copper corrosion experts, and

representatives from PWSs, States, and federal agencies with Healthy Homes and childhood lead poisoning prevention programs.

Other Federal Actions

- A federal tax deduction to support replacement of the customer portion of LSLs.
- EPA should work with CDC and HHS to ensure that the standard protocol for investigation of any child with elevated blood lead levels or of a home with lead levels above the HAL include determination of whether there is a lead service line.
- EPA should work with HHS and HUD to modify funding guidelines for the Healthy Homes and other federal funding programs to explicitly authorize and prioritize the use of those funds for lead service line removal programs targeting the privately owned portion of any lead service line. The current situation of having tens of thousands of dollars spent by a local Healthy Home or lead poisoning prevention program to remove lead paint, and leave behind a lead service line because of arbitrary funding guidelines is unacceptable.

State or Local Actions

- Local or state building and plumbing codes, including possibility of prohibiting copper plumbing where water is aggressive to copper.
- State Actions to support customer lead service line replacement, e.g.
    - State legislation requiring inspection or replacement on sale of home
    - Disclosure requirements at sale of home
    - Requirements for LSL removal as part of school and day care licensing
    - Building code requirements for LSL removal upon substantial renovation (could be national action as well)
    - Priority in DWSRF funding, especially if increased funding is available. (Criteria states might wish to consider include: PWSs where there is a high incidence of elevated BLLs for children, a high percentage of homes with LSLs, a high percentage of low income families, the PWSs prior efforts to replace LSLs, etc)[13]
- States should consider including requirements for lead in drinking water in state child care licensing rules.

Public Water System Actions

- Options EPA may want to describe in guidance and PWSs could consider include but are not limited to:
    a. Rate design considerations:
        i. Low rates for low volumes
        ii. Household size-based rates

[13] Good examples of programs which facilitate and enable private action include a Massachusetts program which provides a state income tax credit for the replacement of failing private wastewater treatment systems (septic tanks and leaching fields) coupled with a requirement for inspection and compliance with stricter rules upon property transfer; and many local housing rehabilitations programs funded by Federal Community Development Block Grants (CDBG) which provide low or no interest loans for health and safety related improvements, payable upon property transfer, often with loan sunsets where repayment is not required or the balance is reduced over a period of continued occupancy by an income-eligible homeowner. A similar loan program could be authorized by EPA under the Drinking Water SRF program.

b. Non-rate policies
   i. Budget billing
   ii. Fixture retrofits and plumbing assistance by the PWS
   iii. Service line replacement and insurance programs not provided by PWS
   iv. Direct assistance, emergency bill payment relationships
   v. Fixture retrofits and plumbing assistance by NGO organizations providing affordable housing
   vi. Subsidies including LSL / connection replacement costs associated with street, sidewalk, and other repairs not related to drinking water infrastructure
   vii. On-bill financing provided by the PWS
c. Funding guidance
   i. EPA's Financing for Environmental Compliance – Water
   ii. Tools for Financing Water Infrastructure
d. Funding sources beyond rate revenue:
   i. EPA's Drinking Water State Revolving Fund (DWSLF)
   ii. EPA Targeted Grants to Reduce Childhood Lead Poisoning
   iii. USDA's Water and Environmental Programs, U.S. Department of Agriculture, Rural Development
   iv. HUD's Community Development Block Grant Program – U.S. Department of Housing and Urban Development
   v. HUD Healthy Homes Technical Studies
   vi. HUD Office Healthy Homes and Lead Hazard Control Lead Hazard Reduction Demonstration Program
   vii. HUD Health Homes Initiative Lead Elimination Action Program
   viii. HUD Office of Healthy Homes and Lead Hazard Control Lead Hazard Control Lead Technical Studies Grant Program

- PWSs should educate and encourage partnerships with healthcare providers and health departments even when levels are below the AL.

<u>Research</u>

- Additional technical review and/or additional study is needed on how to conduct household and service line flushing to remove particulate lead.
- Published, peer reviewed research explaining that water in plumbing systems with leaded materials and LSLs can have sufficient levels of lead in the water to be a risk to those consuming the water. This paper is important to gaining support from the public health agencies and others and to placing water in context with other sources of lead.
- Considering that lead remains a complex issue and that research and information gaps still exist, the EPA should establish a Research and Information Collection Partnership to encourage the filling of these gaps in knowledge. The RICP should be initiated once the EPA begins working on the revised rule and continue for three years or more into the promulgation of the revised rule.
- The EPA and other agencies, such as the Water Research Foundation, should conduct research (such as bench scale and limited system case studies) to confirm the bins selected to define aggressive waters for copper. The bins are based on theory and need some level of confirmation prior to promulgating an actual regulation. This work can be done within the timeframe of developing a final rule.

5 Conclusion

The LCRWG appreciates the opportunity to provide these recommendations to the NDWAC, offers our thanks to the experts and members of the public who made presentations to the work group, and wishes particularly to acknowledge EPA for the extensive commitment of staff time and expertise to this process.

ATTACHMENT A

NDWAC Lead and Copper Working Group

Members
Christina Baker: Deputy Public Counsel, Office of the Public Counsel, State of Missouri
Leon Bethune: Director, Office of Environmental Health, Boston Public Health Commission
Gary Burlingame: Director, Bureau of Laboratory Services, Philadelphia Water
Marilyn Christian: Manager, Environmental Health Programs, Harris County Public Health
Matthew Corson: Manager, Environmental Compliance, American Water
Derrick Dennis: Water Quality and Data Management Section Manager, Office of Drinking Water, State of Washington
Stephen Estes-Smargiassi: Director of Planning, Massachusetts Water Resources Authority
Yanna Lambrinidou: Parents for Non-toxic Alternatives *[dissenting]*
Thomas G. Neltner: Environmental Defense Fund
John Sasur Jr.: Three Rivers Fire District, Massachusetts
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

Table 1: Elements of utility reports by dates in three-year cycle (*based on EPA adoption of rule in 2017)

Action	2020*	2023	2026	2029	2032	2035	2038	2041	2044	2047	2050
Confirm broad and targeted education programs underway[1]	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.
Status of consumer sampling[2]	NA	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered
Confirm communication of sampling results[3]	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.
Confirm operation policies in place[4]	Yes. If not, then explain	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.
Replacement Progress[5]	Initial Baseline	85% remaining	70% remaining	55% remaining	40% remaining	25% remaining	17% remaining	10% remaining	6% remaining	3% remaining	0% remaining
If replacement goals not met, number of checklist items confirmed completed (See Table 2)[6]	Basic requirements *[see Section 3.1.2]*	Basic requirements	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)

[1] See Section 3.1.2 (item 4 "targeted outreach" EPA to provide a checklist; PWS to contact customers with LSLs individually at least every three years and when there is a new customer at that address.

[2] Number of customers offered opportunity to conduct at-tap samples and number of samples taken.

Confirmation that results were provided to the customer. Number exceeding the household action level and confirmation that the results were submitted to health department. Maintain records for review by the primacy agency.

[4] Program to ensure that emergency, maintenance and renovation operations consider risks of disruption to service line increasing lead exposure to residents. .See Section 3.1.2 item 7 (operations).

[5] A service line is presumed lead unless installed after date installation of lead service line prohibited or records or tests by utility confirm entire service line is not lead. Confirming that a service line is not lead counts toward replacement progress.

[6] This is a two-fold concept, the details of which the LCRWG suggests be determined by EPA: 1) provide the PWS the flexibility to select outreach methods and other efforts appropriate to that community and 2) increase the number of required efforts to be completed if replacement goals are not met. See Table 2 for checklist of options for additional effort (in addition to the basic outreach requirements).

Table 2 Options (in addition to the basic outreach requirements) to be accomplished by utility if replacement progress goals in Table 1 not met.[1]		
Basic outreach requirements: • Individually notify customers with known or possible LSLs describing the risks of lead in drinking water, specifically inviting them to participate in the LSLR program, offering to have the customer's tap water analyzed, and clearly describing the terms of the program and how to follow up. If the customer does not respond or chooses not to participate, the PWS must follow up with another invitation at least every three years and always when there is a new customer at that address. (see Section 3.1.2 for additional details) • Provide a written offer to replace the LSL when work is being done on the water main in the street (with the same information above).		
Resident engagement	System policies	Other
1. Notice to new customers of need	1. Plumbing code requires full replacement if service line will be disturbed.	1. Local health agency contact with resident.
2. Written offer to replace when main in street rehabbed (customer pays)	2. Grants or low-interest loan funds identified to cover customer costs sufficient to maintain progress for period.	2. Local health agency funding for removal as part of remediation
3. Written offer to volunteer (customer pays)	3. Financing options such as liens on home provided to customers or tax deductions for property owner costs.	3. Media campaign launched
4. Written refusal from customer(s)	4. MOU or other arrangement to implement notification of customers/property owners by other utilities about replacement options if LSL is disturbed	4. Homeowner association(s) send letters to members supporting replacement.
5. Certified letters sent	5. Capital improvement plans target system pipe rehab and replacement to areas with more LSLs	5. Real estate organizations notified of requirement for replacement of LSL on sale or transfer of title
6. In-person call or visit made	6. Service line insurance program revised to include replacement LSLs if damaged or leaking	6. Cooperative outreach efforts with non-profits
7.	7. More aggressive flushing in areas with LSLs to manage iron related lead particles	7. Coordinated outreach with WIC
8.	8.	8. Outreach to plumbers/contractors
9.	9.	9. Outreach to ob/gyns and pediatricians
10.	10.	10. Local ordinance requiring inspection/notification/replacement of LSLs upon sale or transfer of title
11.	11.	11. LSL identification added to home inspector standard operating procedures
12.	12.	12.
[1] EPA will provide guidance on the options and update them periodically as best practices evolve.		

Message

From: Burneson, Eric [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=2CACB9A8D49F49AF80531E9E2CCB9018-EBURNESO]
Sent: 3/24/2014 9:43:28 PM
To: Darrel Osterholdt [dosterhoudt@asdwa.org]
Subject: FW: Amended LCR NDWAC Working group presentation
Attachments: DD_NDWAC Working Group Presentation LCR Background eh 3-20-14.pptx; DD_NDWAC Working Group Presentation Issues eh 3-20-14.pptx

Thanks for sharing your presentation Darrell. Here for your information are the slides I am using. I think they will work well together.

Eric Burneson, Director
Standards and Risk Management Division
Office of Ground Water and Drinking Water
US Environmental Protection Agency

Phone: 202-564-5250
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U.S. Environmental Protection Agency

NDWAC Lead and Copper Working Group

Lead and Copper Rule Long-term Revisions: Introduction of Key Issues for NDWAC Consideration

Presenter: Eric Burneson, Director
U.S. EPA, Office of Ground Water and Drinking Water,
Standards and Risk Management Division

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NDWAC Lead and Copper Working Group

Purpose of Presentation

To highlight for the NDWAC Working Group five areas where EPA is currently considering a range of regulatory revisions and is seeking detailed stakeholder input (additional topics areas maybe added by Working Group members)

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EPA's Goal for the Long-term Revisions:

Improve the effectiveness of corrosion control treatment in reducing exposure to lead and copper and to trigger additional actions that equitably reduce the public's exposure to lead and copper when corrosion control treatment alone is not effective.

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Key Issues for Input

EPA has initially identified five key areas for input:

- Sample site selection criteria for lead and copper
- Lead sampling protocol
- Public education for copper
- Measures to ensure optimal corrosion control treatment
- Lead Service Line Replacement (LSLR)

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Sample Site Selection Criteria - Issues

EPA is evaluating whether 1991 sampling site criteria are still appropriate to assess effectiveness of corrosion control for lead and copper.

EPA is considering:

- two separate site selection criteria: one for systems with Lead Service Lines (LSL), one for non LSL systems
- requiring systems to conduct copper monitoring at separate sites with new copper piping
- a copper monitoring waiver for systems with water that is not aggressive to copper

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Lead Sampling Protocol - Issues

- Water in the lead service line (LSL) is most likely to have the highest concentration of lead.
  - The current sampling protocol (first draw sample) does not capture water representative of the lead service line.
  - Considering requiring LSL systems to collect samples that capture water that spent stagnation period in the service line.
- Flushing the tap prior to the start of the stagnation period may lower first draw lead levels.
  - Considering prohibiting systems from instructing samplers to flush tap prior to stagnation period
- Removing and cleaning aerators only prior to sampling may prevent systems from identifying lead in drinking water .
  - Considering prohibiting systems from instructing samplers to remove and clean aerators prior to sampling
- Number of samples needed
  - What is the appropriate number of sites to be sampled to assess both lead and copper corrosion?

Public Education for Copper - Issues

- No educational or exposure mitigation materials are currently provided for copper.
- Health effects of copper are nausea and vomiting (short-term)
  - may be liver damage, possible immune system depression in sensitive subpopulations (Wilson's disease and carriers of Wilson's disease gene)
- EPA is considering whether education materials should be provided to consumers

Optimized Corrosion Control - Issues

Maintaining OCCT can be challenging when faced with making necessary adjustments to treatment processes or system operations unrelated to corrosion control to comply with other NPDWRs.

EPA is considering:

- Expanding the scope of the required study for systems with LSLs to include a system-wide assessment of factors that may limit the effectiveness of the CCT or the ability of the system to optimize their treatment.
- requiring systems using orthophosphate to evaluate higher doses and those systems not using orthophosphate to study its use
- Revising the steps and deadlines for corrosion control treatment.
- Allowing Non Transient Non Community Water Systems (NTNCWSs) serving fewer than 10,000 people the option of installing Point of Use (POU) treatment units

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Lead Service Line Replacement Requirements - Issues

EPA's Science Advisory Board concluded partial lead service line replacements (PLSLRs) have not been shown to reliably reduce drinking water levels in the short term … Additionally PLSLR is frequently associated with short term elevated drinking water levels …

EPA is considering:

- Delaying mandatory LSLR until after reoptimization of corrosion control treatment
- An expanded definition of "control" as it applies to LSLs in the distribution system that includes the authority to set standards for service lines; to replace, repair or maintain the line; or ownership of the line
- Eliminating PLSLRs requirements when the private property owner does not agree to pay for their portion of the LSL
- Eliminating the "test-out" provision
- Requiring systems to provide residents with a NSF/ANSI 53 certified pitcher filter before the LSLR

Interconnection of Key Topic Areas

- The five topic areas have interconnections that should be considered when recommending changes to the rule structure.
- Examples include:
  - Changing the site selection criteria and sampling protocols could result in more systems exceeding action levels for lead or copper. How can the optimized corrosion control requirements be structured to most effectively assure these systems reduce lead and copper levels?
  - Will systems have incentive to take all steps to optimize corrosion control without threat of a lead service line replacement requirement?

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NDWAC Lead and Copper Working Group

Why is EPA Forming a Working Group?

EPA has sought public input on potential revisions to the LCR through a number of stakeholder interactions since 2008.

EPA has used this input to identify key issues and potential revisions to improve the effectiveness of the rule

EPA needs more input to assure the potential revisions are feasible, implementable and likely to achieve the intended outcome.

EPA needs more input to evaluate how potential changes to one part of the rule impact other parts of the rule

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NDWAC Lead and Copper Working Group

NDWAC Working Group Structure

The Working Group will explore the specific technical issues identified by EPA along with the additional issues raised by Working Group member and will:

- provide suggestions on how to implement the goals for LCR revisions
- provide information/data
- share perspectives on advantages and disadvantages of options under consideration, and
- suggest additional topics/approaches

The Working Group will provide the NDWAC group advice where consensus is reached and alternatives where consensus is not reached

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Things To Consider in Formulating the Working Group Input

- **Feasibility:** The SDWA requires that the treatment technique be set as close to MCLGs "as is feasible," except when EPA determines that the cost of a standard at that level are not justified by the benefits, or when certain "risk-risk" considerations apply. SDWA [1412(b)] Sec. 104
  - If cost is not justified by benefits, the law allows EPA to set a treatment technique that maximizes health risk reduction benefits at a cost that is justified by the benefits. SDWA [1412(b)(6)] Sec. 104
  - If the technology to meet the treatment technique would increase health risk by (i) increasing concentration of other contaminants in drinking water, or (ii) interfering with treatment used to comply with other NPDWRs, EPA may set the treatment technique at a level other than the feasible level. The goal of this risk balancing would be to achieve a greater health benefit. SDWA [1412(b)(5)] Sec. 104
- **Cost and Benefit Important:** EPA must make a determination as to whether the costs of the standard are justified by the benefits.
  - The cost benefit analysis supporting this determination must include, consideration of effects on sensitive subpopulations. EPA will also look at the benefits to and cost born by EJ communities both in terms of relative and total impacts. SDWA [1412(b)] Sec. 103, SDWA [1412(b)(6)] Sec. 104, E.O. 12898
- **Measurement of Uncertainty:** EPA must communicate, to the extent practicable, the population addressed by the regulation; the central, upper and lower estimates of risk; significant uncertainties and studies that would help resolve uncertainties; and peer-reviewed studies that support or fail to support estimates. SDWA [1412(b)] Sec. 103
- **Anti-backsliding:** The law requires that any revisions to NPDWRs "shall maintain, or provide for greater, protection of the health of persons" SDWA [1412(b)(9)] Sec. 104(c)

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Comments and Feedback

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NDWAC Lead and Copper Working Group

Lead and Copper Rule: Background

Presenter: Eric Burneson, Director
U.S. EPA, Office of Ground Water and Drinking Water,
Standards and Risk Management Division

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U.S. Environmental Protection Agency

NDWAC Lead and Copper Working Group

Purpose of Presentation

To provide background information to the NDWAC Working Group on the current Lead and Copper Rule (LCR)

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NDWAC Lead and Copper Working Group

Background: Health Effects

Exposure to lead can cause damage to the brain, and kidneys, and can interfere with production of red blood cells. Young children and pregnant women at greatest risk.

The Maximum Contaminant Level Goal for lead (MCLG) is zero.

Exposure to Copper can cause stomach and intestinal distress, liver or kidney damage, and complications of Wilson's disease in genetically predisposed people.

The MCLG for Copper is 1.3 mg/L.

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Background: Lead and Copper Rule (LCR)

EPA under the Safe Drinking Water Act (SDWA) sets public health goals and enforceable standards for drinking water quality

Lead and Copper: National Primary Drinking Water Regulation (NPDWR) initially promulgated June 7, 1991

The goal of the LCR is to:

> Protect public health by minimizing lead and copper levels in drinking water, primarily by reducing water corrosivity

The rule applies to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs)

4

Under the "goal of the LCR..."
Remind the group:
This is the difference between the LCR and other NPDWRs. The overall goal is the same (public health protection); however, the method by which we achieve PHP in the LCR is by Treatment Technique (TT).
We use a TT because of the location and behavior of the contaminants we are addressing (in service lines and private plumbing)
Reducing the corrosivity of the water is the main action the LCR uses to lower lead and copper levels at the tap

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Background: Monitoring

All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are subject to monitoring requirements

Systems must collect first-draw samples at taps in homes/buildings that are at high risk of lead and copper contamination

The number of required samples varies by the size of the population served by the system, from 100 samples for large systems serving over 100K people down to 5 samples for systems serving 100 or fewer people

Systems must conduct monitoring every 6 months unless they qualify for reduced monitoring

The number of required samples and sampling frequency may be reduced if systems meet certain requirements

5

The treatment technique, here, is a suite of sequential actions which the system must perform to lower levels at the tap.

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Background: Action Levels

Monitoring results are compared to action level (AL)

Lead = 15 µg/L (based on technical feasibility)
Copper = 1.3 mg/L (set at the health based MCLG)

If more than 10% of the samples exceed the AL in a system that has not already optimized corrosion control treatment, then the system must

- Conduct Public Education for Lead (only if the lead AL is exceeded)
- Work with the state to designate, install and operate corrosion control treatment.

If more than 10% of the samples exceed the AL for lead in a system that has already optimized corrosion control treatment, then the system must

- Conduct Public Education for Lead
- Conduct Lead Service Line Replacement (if the system has LSLs)

A system that exceeds the AL is <u>not</u> in violation

Emphasize that there is a sequence to these actions, and LSLR is only triggered if OCCT does not reduce tap levels below the action level.

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Background: Public Education for Lead

Provide information on health effects of lead and steps to reduce exposure

Community Systems :

deliver materials to bill-paying customers and post lead information on water bills

work in concert with local health agencies to reach at-risk populations (e.g. children, pregnant woman)

provide press releases and conduct new outreach activities

post to Website (CWSs serving > 100,000 only)

Non Community Systems:

posting and distribution to all consumers (can be electronic with State permission)

Can apply to CWSs such as hospitals and prisons where population cannot make improvements

7

Blank Example

NDWAC Lead and Copper Working Group

Background: Optimal Corrosion Control Treatment (OCCT)

Systems serving more than 50,000 people required to work with state to designate , install and begin operating OCCT 1994-1998

Systems serving 50,000 or fewer people must begin process to designate , install and operate OCCT only when the system exceeds the AL for lead or copper.

6 + Year process to designate, install and operate OCCT includes

- Systems make optimal corrosion control recommendation to State for approval
- State approves or designates alternative
- System installs OCCT and conducts follow-up monitoring for one-year
- State reviews data and designates optimal water quality parameters (WQP) (i.e., min/max pH, alkalinity, inhibitor concentration, etc.)
- Systems maintain WQP, and report to State (in addition to lead/copper tap sampling)

U.S. Environmental Protection Agency

NDWAC Lead and Copper Working Group

Background: Lead Service Line Replacement (LSLR)

Systems must replace at least 7% of LSLs annually (partial or full LSLR)

- Replace the portion of the LSL owned by the system
- Offer to replace the owner's portion (system is not required to bear the cost of replacing the privately owned portion or to replace private line where prohibited by State, local or common law)

Systems conducting partial LSLRs must:

- Notify customers at least 45 days prior to replacement about the potential for increased lead levels
- Collect samples within 72 hours of replacement and provide results within 3 days of receipt

Systems may "test out" a LSL if all samples from the line are below the lead AL

Systems can discontinue LSLR whenever lead tap samples are at or below the AL for 2 consecutive 6-month monitoring periods

Blank Example

U.S. Environmental Protection Agency

NDWAC Lead and Copper Working Group

Comments and Feedback

Blank Example

Message

From: Roberson, Alan [aroberson@asdwa.org]
Sent: 5/23/2018 9:46:03 PM
To: Rodgers-Jenkins, Crystal [Rodgers-Jenkins.Crystal@epa.gov]
CC: Burneson, Eric [Burneson.Eric@epa.gov]
Subject: Re: FY 19 SRMD Draft Scope
Attachments: FY19 SRMD 05232018 Draft.docx

here you go - my apologies for missing a couple of these - I found the first one but missed the next two....

Alan

On Wed, May 23, 2018 at 4:56 PM, Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov> wrote:

> Eric, Alan and I chatted today about the latest version of the document. There is one phrase left in the document related to "budget cuts". He will delete that phrase and re-send.
>
> **From:** Roberson, Alan [mailto:aroberson@asdwa.org]
> **Sent:** Wednesday, May 23, 2018 3:22 PM
> **To:** Burneson, Eric <Burneson.Eric@epa.gov>
> **Cc:** Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>
> **Subject:** Re: FY 19 SRMD Draft Scope
>
> Crystal (and Eric), here is the latest version - I accepted all of your edits and then addressed Eric's comments so I think we are good to go and will call you at four for a short conversation...
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> >
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> > > Alan:

It was good to see you at today's PFAS leadership summit. As I mentioned when we spoke, an unexpected conflict has occurred on my schedule today and I cannot make our meeting time to discuss your draft. However I have reviewed the information and have some comments and suggested edits attached for your consideration. If you have any questions you can call me and or discuss with Crystal who will be available to speak with you later today.

Thanks for your continued work to facilitate State – EPA collaboration on these key drinking water program issues.

Eric

Eric Burneson, P.E.

Director of Standards and Risk Management

Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

202 564 5250

From: Roberson, Alan [mailto:aroberson@asdwa.org]
Sent: Monday, May 21, 2018 7:59 PM
To: Burneson, Eric <Burneson.Eric@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>
Subject: FY 19 SRMD Draft Scope

Eric and Crystal, am trying to clear the decks before all things PFAS so here is our draft that we can talk about Wednesday....

Alan

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ASDWA-EPA Cooperative Agreement: Proposed Areas of Work in *Standards and Risk Management Division*

Note: FY 18 funds would be committed to a Cooperative Agreement Amendment to be Submitted to EPA-OW & GAD in June 2018 – to be spent in FY 19

Rule Development and Regulatory Tools:

- **State Input into Rule Development Activities:** ASDWA has supported and will continue to support state members on EPA workgroups involved in regulation development. Perchlorate and the Long-Term Revisions to the Lead and Copper Rule are the two proposed regulations currently under development by SRMD. ASDWA will provide comments on the proposed regulations once either of the proposed rules are published. The states on the workgroups will assist ASDWA in apprising other states of the proposed rule requirements and explaining the rationale behind the various provisions to help states and ASDWA provide useful comment. ASDWA will also provide input to other ongoing regulatory activities as needed, including soliciting states' issues and information related to potential revisions to regulations identified in the 3rd Six-Year Review, or other regulatory issues.

- **Perchlorate:** ASDWA will continue to monitor the recently completed model peer review and inform states on its implications on the development of a perchlorate Maximum Contaminant Level Goal (MCLG). If needed, ASDWA will re-populate the perchlorate workgroup with the appropriate state representatives to provide input for EPA's consideration in developing a proposal and will support state interaction with EPA during the proposal's comment period.

- **Long-Term Revisions to the Lead and Copper Rule (LT-LCR):** ASDWA will continue to monitor the recently completed model peer review for the development of a health-based benchmark (HBB) and inform states on its potential implications as part of the proposed LT-LCR. ASDWA will seek input from states members on materials inventories, tap sampling and corrosion control treatment and other potential LT-LCR issues to provide input for EPA's consideration in developing a proposal. If proposed in FY 19, ASDWA will support state interaction with EPA during the comment period and will develop ASDWA's comments on the proposal. ASDWA will also seek input from state members on other lead and copper rule related issues to be sure all state perspectives are represented in input to EPA during development and in response to a proposed rule.

- **Support for Reduction of Lead in Drinking Water Act (RLDWA):** ASDWA will continue to support states as they implement the requirements of the new lead content requirements, if any implementation questions arise, and ASDWA will work with EPA to answer such state questions. ASDWA will also facilitate, if needed, state input to EPA as

the Agency develops a final regulation to implement the RLDWA. ASDWA will inform states and assist them with implementation of the final rule. ASDWA will continue to promote the use of EPA's list of Frequently Asked Questions (FAQs) by states in answering questions about the changes in the Act.

- **Ongoing Lead and Copper Rule Related Activities, post-Flint:** States' priority will be to assure that the current LCR requirements are fully implemented and that water systems are taking appropriate steps to reduce lead levels and keep the public adequately informed about lead in their drinking water. ASDWA will support the states in considering the NDWAC recommendations to provide additional public health protection. This could include encouraging systems to proactively remove lead service lines; promoting alternative sampling regimes to better characterize lead exposure; working with other national organizations (ASTHO, APHL, APHA) on any lead reduction initiatives; and supporting state work with local health agencies to address individual homes with high lead. Additionally, ASDWA will continue to provide states' input on the implementation of the strategic plan for third-party sampling lead notifications and the 24-hour Action Level (AL) exceedance notifications resulting from the Water Infrastructure Improvements for the Nation (WIIN) Act. ASDWA will develop comments on the 24-hour AL exceedance notifications that are anticipated to be included in the proposed LT-LCR.

- **Perfluorinated Chemicals (PFCs):** PFCs have become a much more significant issue for the water sector over the past couple of years, as shown by EPA's PFAS Leadership Summit on May 22-23, 2018. This Summit will be start of several cooperative EPA/state actions and collaborations. ASDWA will seek input from states on any technical and policy issues resulting from that Summit and will support states and EPA in the implementation of the resultant Action Plan from that Summit.

- **Support for the Fourth Unregulated Contaminant Monitoring Rule (UCMR4):** Even though the rule is directly implemented by EPA, ASDWA will continue to track the progress of UCMR4, and will continue to provide information to states and answer any questions, as needed. ASDWA will publicize and support states that take an active role in implementation through partnership agreements with EPA. ASDWA will collaborate with SRMD-TSC as the UCMR4 rule is implemented to help ensure that states are informed and can participate in any implementation activities, as appropriate. In preparation for the release of UCMR4 results in fall of 2018, ASDWA will continue to work with SRMD and TSC and states to develop appropriate messages and risk communication materials that can be used by states and water systems when UCMR4 contaminants have been detected, including any risk communication issues that may arise between the regulated HAA5 and the UCMR4 monitoring for HAA9. ASDWA will work with SRMD and TSC and states to ensure that the Reference Concentrations (RfCs) are used appropriately as part of the release of UCMR4 results.

- **Health Advisories:** Health advisories, although nonregulatory, have taken on a more prominent role in guiding public water systems to address contamination from contaminants where there is no MCL. As a result, states have become more active in using these tools to protect public health. The most recent HAs for cyanotoxins and 2 Perfluorinated Chemicals (PFCs) (PFOA and PFOS) are continuing to drive alternative water supplies and remediation and public notification activities in many public water systems and states will continue to be there to assist. While EPA is not currently developing any new HAs, ASDWA will continue to work with EPA to ensure that states and water systems have adequate information to decide how to react and what to tell customers and the public about the health risks and answer any questions about the most recent HAs for cyanotoxins, PFOA and PFOS. This includes analytical method and sampling information, treatment options, and messaging. ASDWA will work with Sates and EPA in efforts to implement the NDWAC recommendations on the development and implementation of any future health advisories. ASDWA will work with States and EPA to identify the critical information needed in advance of issuing any future health advisories.

- **Cyanotoxins:** Using an adaptive management approach based on lessons learned over the past few years, ASDWA will continue to provide states' input to EPA on updating both the risk communication and risk management tools for cyanotoxins. ASDWA will promote the use of EPA tools and resources, as well as the recently developed tools from the Water Research Foundation and tools developed by other states and federal agencies.

- **Building Water Quality and *Legionella*:** As more and more hospitals and health care facilities develop water quality management plans to comply with the CMS requirements, states continue to have their own *Legionella* issues to address. ASWA will support states in determining the most appropriate actions to assure building water quality including the installation of treatment in buildings served by other Public Water Systems. ASDWA and states will continue to participate in EPA-ASDWA Workgroup discussions on *Legionella* issues and provide any information to the Workgroup, as needed. ASDWA will assist with development and distribution of useful guidance, or other policies to assure oversight of building water quality and the owners and operators who provide treatment. ASDWA will continue to monitor the *Legionella* study being conducted by the National Academy of Sciences.

- **Six-Year Review:** ASDWA will continue its involvement in the ongoing dialogue regarding the EPA published results related to the Third Six-Year Review and provide input to EPA for its deliberations. ASDWA will work with EPA in its preparation for the Fourth Six-Year Review.

- **Emerging Issues:** ASDWA will provide input to EPA on other emerging contaminants such as 1,4-dioxane and TCP, as well as "older" contaminants such as glyphosate and manganese where new and emerging health effects data could change the relative

public health importance of these contaminants. ASDWA will also be involved in other issues with significant public health implications, such as water reuse and the use of other alternative water sources

- **Rule Development Presentations at ASDWA Meetings:** The most recent ASDWA Annual Conference and ASDWA Member Meeting each included sessions on new rules and regulatory tools. All the presentations are available to members on the ASDWA website after the conferences. Sessions will be planned for the 2018 Annual Conference in October 2018 and the 2019 Member Meeting as well. In addition, ASDWA staff will continue to make presentations at meetings and conferences sponsored by other organizations, such as the AWWA Annual Conference and Water Quality & Technology Conference (WQTC) to provide the states' perspective on regulatory issues.

- **Tracking Related Activities of Other Entities:** In addition to direct workgroup support, ASDWA staff monitors activities of the National Drinking Water Advisory Council, Science Advisory Board, IRIS Toxicological Assessments, etc. as they consider the pros and cons of various issues that will impact rule development. This allows ASDWA to keep states informed of upcoming issues and provide state input when necessary. ASDWA will continue to monitor these activities and others as appropriate.

- **Executive Order (EO) 13777 and Regulatory Review:** ASDWA will continue to provide states' input on regulatory review issues as EPA moves into EO 13777 implementation.

Analytical Methods Issues:

- **UCMR5 Methods:** ASDWA will facilitate state engagement on EPA's development of UCMR5 analytical methods and on the methods themselves, as well as facilitating state engagement on what contaminants should be monitored under UCMR5.

- **Expedited Methods Approval:** ASDWA will continue to inform states of new analytical methods approved on an annual basis under the expedited method approval process and will continue to do so as new methods are released.

- **Other Analytical Method Issues:** ASDWA will continue to keep states informed of developments related to analytical methods. This includes announcing the release of new analytical methods, particularly by EPA, providing information about QA/QC issues related to existing methods. ASDWA will provide states' input on any chlorine residual analytical methods issues such as di- and tri-chloramine interference issues, and provide input on any methods guidance that EPA may develop. ASDWA will continue to share information and resources on analytical methods for unregulated or emerging contaminants such as cyanotoxins, and what methods and contaminants might be considered for the Fifth Unregulated Contaminant Monitoring Rule (UCMR5).

Exchanging Information about Emerging Technologies:

- As another means of support for states, ASDWA's Forums includes a forum on treatment technologies; primarily related to UV and membranes to allow states to share expertise and experience with new technologies. ASDWA includes EPA in this forum and promotes its use by state staff as a way of sharing expertise on treatment of all kinds. ASDWA also participates in calls on treatment technology issues hosted by NSF and similar Q&A conference calls hosted by EPA. In the coming year, the treatment technologies forum and other tools on ASDWA's website may be expanded further to enhance state data sharing, which will allow states to tap into additional expertise from other states when they face challenges with new technologies. ASDWA will continue to bring forward the states' perspectives in the AWWA/WWEMA Innovation Initiative to promote usable technology for achieving regulatory compliance. ASDWA will also continue to work with the two EPA-funded National Centers for Innovation in Small Drinking Water Systems (WINSSS [Steve Wilson] and DeRISK) as they transition out of their respective EPA funding.

Area Wide Optimization Program (AWOP):

- **AWOP Transition:** ASDWA will facilitate ongoing state engagement (the AWOP states) with EPA as the program continues to evolve. ASDWA will provide the states' input on how the program might be modified/adapted in the future. ASDWA will continue to provide states' input on the strategic direction for AWOP, as to whether additional effort should be expended to recruit additional states or additional topics such as distribution systems and corrosion control should be added to the program.

- **Support for Regional AWOPs**: ASDWA staff has attended and plans to continue to attend AWOP quarterly meetings in all four Regions (3, 4, 6, and 10) in person and by web conference. ASDWA will continue to provide support for other quarterly meetings and training events by participating in planning for the event and by offering support for state participants to travel (on an as-needed basis).

- **New AWOP States:** New states continue to express interest in AWOP. Over the past two years, Michigan, New Hampshire, Minnesota, North Dakota, Ohio, and Regions 1 and 5 have asked about the program. Michigan, Kansas, Missouri, and Montana are the newest AWOP states, and following a suggested preparatory training regime, but may need additional support as they become fully active. ASDWA will hold conference calls and on-site meetings as necessary to provide additional information to other interested states. ASDWA is also helping the NOLT support reenergizing the Florida and New Mexico programs and incorporating a renewed Delaware program into Region 3. ASDWA will continue to work with these new/renewing states in the coming year to support their transition to fully active AWOP members. Also, ASDWA will be monitoring interest from other states in Regions 1, 2, 5, 7 and 8.

- **Incorporation in ASDWA Meetings and Conferences:** Encouraged by ASDWA, the 2018 ORD/OGWDW Small Systems Workshop and the 2018 ASDWA Annual Conference will include AWOP related presentations and discussions. AWOP-related sessions will be planned for various ASDWA-sponsored meetings in 2019 as well.

- **AWOP Communications:** ASDWA worked with SRMD-TSC and states to compile and produce articles for the *AWOP News blog*, an electronic newsletter dedicated to AWOP. ASDWA is working with the AWOP Communications Committee and National Optimization Leadership Team to improve and expand the content of the blog for support of the AWOP community and outreach to other interested groups.

- **AWOP Web Site:** The AWOP website (hosted by ASDWA) is used by the AWOP leadership team, regional AWOPs, and outside parties. ASDWA will continue to improve the site with assistance of the AWOP Communication Committee. In 2018, ASDWA and EPA will complete transitioning much of the technical data related to AWOP to a SharePoint site maintained by EPA. However, the ASDWA site will be continued to be maintained in tandem for AWOP support such as state communication. An AWOP forum will continue to be used for communication among the AWOP community. ASDWA will continue to improve the site with the assistance of the AWOP Communication Committee, ASDWA will continue to maintain this site. The main AWOP pages will be targeted to an outside audience, including providing information to prospective new AWOP states.

- **Coordination with Partnership for Safe Water:** ASDWA staff and an official ASDWA representative (Eric Hudson from NC) participate in monthly conference calls of the Partnership for Safe Water (PSW) Steering Committee. ASDWA will support the ASDWA representative to the PSW Steering Committee as he officially represents the interest of states. ASDWA will share PSW newsletters, information about their new Distribution System optimization program, and other information through ASDWA's *Weekly Update* e-newsletter. ASDWA will also be helping to support a more active relationship between the Partnership and AWOP as new Partnership leadership seeks to continue to build bridges between the two optimization groups.

- **National Optimization Leadership Team (NOLT):** ASDWA participates in all NOLT activities to represent state interests and to help ensure that the program meets the needs of states. ASDWA also helps advocate for the value of the AWOP program as part of other activities, such as during development of new capacity development strategies. ASDWA will continue to be active in the NOLT in FY 18.

- **AWOP National Meeting**: 2019 will be the year of the 8th AWOP National Meeting. ASDWA will work to secure a location for the meeting and begin to work with a NOLT subcommittee on the agenda and speakers.

Message

From: Roberson, Alan [aroberson@asdwa.org]
Sent: 5/23/2018 7:21:56 PM
To: Burneson, Eric [Burneson.Eric@epa.gov]
CC: Rodgers-Jenkins, Crystal [Rodgers-Jenkins.Crystal@epa.gov]
Subject: Re: FY 19 SRMD Draft Scope
Attachments: FY19 SRMD 05232018 Draft.docx

Crystal (and Eric), here is the latest version - I accepted all of your edits and then addressed Eric's comments so I think we are good to go and will call you at four for a short conversation...

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Office of Ground Water and Drinking Water

U.S. Environmental Protection Agency

202 564 5250

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Message

From: Steve Via [SVia@awwa.org]
Sent: 3/8/2018 8:07:55 PM
To: Grevatt, Peter [Grevatt.Peter@epa.gov]
CC: Ross, David P [ross.davidp@epa.gov]; Bowles, Jack [Bowles.Jack@epa.gov]; Burneson, Eric [Burneson.Eric@epa.gov]; Christ, Lisa [Christ.Lisa@epa.gov]; Hanson, Andrew [Hanson.Andrew@epa.gov]; Helm, Erik [Helm.Erik@epa.gov]; Mushkolaj, Iliriana [Mushkolaj.Iliriana@epa.gov]; Tracy Mehan [tmehan@awwa.org]
Subject: Long-Term Lead and Copper Rule Federalism Consultation (Docket ID No. EPA-HQ-OW-2018-0007)
Attachments: 2018 03 08 AWWA LT LCR EPA Federalism Comments.pdf

Good afternoon,

Thank you for providing the American Water Works Association the opportunity to participate in the Long-Term Lead and Copper Rule Federalism Consultation. AWWA's comments have been submitted to the docket and a copy is attached for your convenience. Please feel free to let us know if AWWA can be of additional assistance.

Best regards,
Steve Via

Steve Via
Director of Federal Relations
American Water Works Association
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American Water Works Association
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March 8, 2018

Peter Grevatt
Director, OGWDW
USEPA Headquarters
Mail Code: 4601M
1200 Pennsylvania Avenue, N. W.
Washington, DC 20460

RE: Long-Term Lead and Copper Rule Federalism Consultation (Docket ID No. EPA-HQ-OW-2018-0007)

Dear Mr. Grevatt,

The American Water Works Association appreciates the opportunity to participate in the U.S. Environmental Protection Agency's 2018 federalism consultation on potential long-term revisions to the Lead and Copper Rule. The body of research and experience with lead has grown since the initial federalism consultation on Long-Term Lead and Copper Rule in 2011, and AWWA commends the Agency for its decision to undertake this second consultation.

The primary mission of community water systems is to protect the health of the people they serve. Revisions to the LT-LCR should advance strong customer protections today while we work for a future where lead is no longer in contact with the water we drink. Systems must provide this protection within the means provided by their communities and the constraints of what is operationally and financially feasible. AWWA recommends that the revised LT-LCR result in water systems engaging in:

1. **Development of an inventory of lead service lines**: The inventory should begin with an estimate of the number of lead service lines in each system's service area based on the information available and improve over time through ongoing water system operations, improved detection technology, and community engagement.

2. **Development of plans for the complete removal of lead service lines through a long-term, shared commitment** – Replacing remaining lead service lines is an important, societal undertaking and will require long-term commitments from many partners and a recognition of shared responsibility. Lead service line replacement strategies must consider other water and non-water improvements and customer affordability challenges. Locally developed programs, responsive to local circumstances, are essential. Communities will need to navigate numerous legal and implementation challenges that require time and resources in the face of competing demands.

3. **Application of process control to reduce corrosivity of water reaching customers' homes:** Corrosion control should be robust, and deviations from target conditions should trigger investigation and corrective steps.

4. **Public outreach on lead risk and lead risk mitigation:** Systems should actively and transparently communicate with their customers, particularly customers with lead service lines, about lead risks and steps households can take to evaluate and reduce lead in drinking water.

The proposed LT-LCR is more than a decade in preparation for at least two reasons. First, managing lead in water involves many challenging policy decisions. And second, the science is still evolving to support those decisions. Many of the issues utilities face, in particular how to control particulate lead release, remain poorly understood. Consequently, to move forward quickly, the LT-LCR revisions must focus on improvements to the current rule that provide cost-effective risk reduction with minimal risk of unintended consequences or misallocation of resources.

The LT-LCR revisions represent an opportunity for meaningful health risk reduction by further reducing lead materials in contact with drinking water, encouraging water systems to enhance current corrosion control practice, and bolstering ongoing public education on lead in drinking water. One of the significant developments since the 2011 federalism consultation was the National Drinking Water Advisory Council recommendations. The NDWAC recommendations provide a sound starting point for the LT-LCR revisions, though more recent information should also be considered. Key aspects of rule revisions that can be drawn from the NDWAC report in the near term include:

Individuals and communities need to be empowered to act – Blood lead levels in the U.S. population continue to decline. Still, communities need to better understand lead risks from all sources, including potential exposure from water. Individuals should be empowered to take effective steps to protect their households, and communities should seek to integrate lead risk reduction activities.

Fully removing all lead service lines will require a long-term, shared commitment – Neither individual homeowners nor water systems alone can remove lead service lines. Replacement is a shared responsibility among utilities, customers, government at all levels and other community partners. It will require a long-term commitment and policies to accelerate removal through opportunities such as property transfers. Communities will need to navigate numerous legal and implementation challenges that require time and resources in the face of competing demands. Customers and utilities will face affordability challenges. Locally developed programs, responsive to local circumstances, considering opportunities to reduce lead exposure from all sources, will be essential.

Corrosion control should be carefully evaluated, and if modified, changes should be based on system-specific information using sound process-control practices and system-specific studies -- Each system has specific local water quality and treatment characteristics, so the nation's water supplies are not amenable to a one-size-fits all approach to treatment selection. One thing that has become clear since the initial promulgation of the LCR is that unintended consequences of treatment changes can be catastrophic. The lesson of the successful implementation of the Long Term 2 Enhanced Surface Water Treatment Rule and revised Total Coliform Rule is that tailoring actions to the particulars of each local system yields public health protection at an appropriate cost. Ongoing process control for corrosion control should be robust and trigger investigation and corrective steps, by:

1. Integrating system-specific water quality parameter monitoring with other ongoing distribution system and water treatment process control monitoring.
2. Applying statistical process control strategies to ensure noncorrosive water reaches customers.
3. Flagging deviations from target water quality conditions for investigation and corrective actions.

Corrosion control is a practical, effective and long-term action available to reduce exposure to lead. AWWA encourages EPA to focus on providing utilities the tools, knowledge, and flexibility to select appropriate corrosion control practices for their individual local water quality and treatment characteristics.

The NDWAC recommendations were substantial, and it is not clear if EPA can propose a rule that addresses all of them by August 2018, the anticipated date for a proposal. NDWAC recommendations the Agency has not yet shown that it can complete in a timely manner include:

1. Identify a level of lead in drinking water of public health concern (i.e., NDWAC's proposed household action level).
2. Substantiate the benefit of revising the rule with respect to copper.
3. Identify corrosion control changes that will reduce lead levels further for systems already reliably below the action level while also not leading to undesirable unintended consequences.
4. Dramatically change the method in which tap samples are collected.

As EPA pointed out in its October 2016 white paper, the elements of the LCR are very intertwined. The information available to the public, including EPA's January 8 briefing, do not describe potential rule revision options. Consequently, it is not clear how EPA intends to maintain a balance between the rule elements.

AWWA appreciates the outreach EPA is undertaking to involve states and local government. Actual rule implementation and the burdens associated with it will fall in part on water systems, local communities and state regulators, and more importantly, on individual households. AWWA urges EPA to organize one or more stakeholder meetings that allow the experiences and concerns of advocates for impacted households to be better understood.

AWWA is fully committed to educating systems on the current and revised LCR, assisting systems with evaluating and improving their corrosion control practices, promoting public communications on lead, and advancing full lead service line replacement practice nationwide. Attached are more detailed comments addressing the questions posed by the Agency in its Federalism briefing and comments prepared by Dr. Crawford-Brown on development of a health-based lead concentration of concern. If the EPA LT-LCR team has any questions regarding these comments or would like to become more engaged in our outreach efforts, please contact me or Steve Via at 202.628.8303.

Best regards,

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Attachments: 1

Who is AWWA

The American Water Works Association (AWWA) is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes more than 4,000 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our 51,000-plus total membership represents the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.

Attachment 1

Addressing Questions Posed in Federalism Consultation
Long-Term Lead and Copper Rule Federalism Consultation

(Docket ID No. EPA-HQ-OW-2018-0007)

prepared by

American Water Works Association

for the

U.S. Environmental Protection Agency

submitted

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Addressing Questions Posed in Federalism Consultation

Introduction

Revisions to the Lead and Copper Rule should advance strong customer protections today while we work for a future where lead is no longer in contact with the water we drink.

Systems must provide this protection within the means of the communities they serve and within the practical limitations of what is operationally feasible. AWWA suggests that the revised LT-LCR include the following elements:

1. Development of an inventory of lead service lines.
    - Be based initially on available information.
    - Improve over time through ongoing water system operations and community engagement.
2. Development of a strategy for lead service line removal.
    - Develop and initiate in a timely fashion and proceed at a community-specific pace.
    - Recognize that shared responsibility is necessary for successful, sustainable lead service line replacement initiatives.
    - Follow ANSI/AWWA C810-17, Replacement and Flushing of Lead Service Lines.
3. Application of process control to reduce corrosivity of water reaching customers' homes.
    - Implementing changes in corrosion control based on system-specific information using sound process-control practices and system-specific studies.
    - Integrating system-specific water quality parameter monitoring with other ongoing distribution system and water treatment process control monitoring.
    - Applying statistical process control strategies to ensure noncorrosive water reaches customers' services.
    - Flagging deviations from target water quality conditions for investigation and corrective actions.
4. Public outreach on lead risk and lead risk mitigation.
    - Actively and transparently communicating with their customers, particularly customers with lead service lines, about lead risks and steps they can take to evaluate and reduce lead in drinking water in their home.

The Safe Drinking Water Act provides a sound decision-making framework. Revision of the Lead and Copper Rule is challenging, and the selected solution will have implications for community water systems of all sizes in every state. Which and how many sources of lead are present in the plumbing of a home depend on historical development patterns in that community, not whether the community today is large or small, urban or rural, poor or affluent. Moreover, as we seek to further reduce lead exposures, this rulemaking encounters larger societal questions such as who has a duty to pay for achieving lead risk reduction and when does a public entity like a water system have the right to intrude on private property. The Safe Drinking Water Act allows the Agency to make tough policy decisions, but it also sets the expectations that such decisions will be based on sound science and reflect opportunities for achieving meaningful risk reduction in a cost-effective manner.

Community Water Systems efforts already substantially control lead exposure through drinking water. The next step in additional risk reduction must be financially prudent and not create unintended consequences. In its most recent Six-Year Review data call in, EPA compiled more than 808,000 sample values from 42

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states for the period 1998 to 2005.[1] AWWA's initial analysis of that data reflects data from approximately 23,100 CWSs serving a combined population of 167 million with LCR data in the database for 2003 to 2005 (for CWSs serving populations >500 using surface or groundwater sources). We found that there were 4,100 systems serving an estimated 23.2 million people where all observed values were less than 1 µg/L, and 90% of systems serving more than 10,000 persons have median lead levels below 5 µg/L.

Compliance data is a limited sample and the sampling protocol and sample pool are not representative of community wide exposure, but the Six-Year Review dataset illustrates that nationwide the water supply community is providing water with low lead concentrations. The question at hand is what is the prudent next step to take to further advance lead risk reduction.

Lead is a multi-exposure pathway challenge. Drinking water is one of many potential sources of exposure to lead. The multi-media nature of lead exposure reduction complicates public education and communication. It also involves numerous responsible parties, many of which are not engaged through the LCR. While the burden of lead health risk should not fall disproportionately on any one group, neither should the burden for achieving lead risk reduction. There is a shared responsibility which is both essential to success and complicates finding timely and affordable solutions.

Reasonable action now is needed. It is desirable but unrealistic to achieve zero exposure to lead in a short period of time. Thus, significant reduction in risk are the appropriate goal. By continuing to debate instead of acting on reasonable rule strategies, as outlined by the National Drinking Water Advisory Council, we continue to delay achieving these risk reductions.

Technical capacity must be built. Nationally, after an initial surge in capacity following promulgation of the LCR, the expert capacity in corrosion control treatment selection has not been adequately developed through academia, maintained in the water system or consulting engineering community, or retained in the regulatory community. EPA and AWWA have roles in supporting the rebuilding of this expertise in the sector. The public health community must also be engaged and educated about lead in water.

Research is needed to support major changes in corrosion control practice aimed at small incremental improvements without causing unwanted unintended consequences. To move forward quickly the LT-LCR revisions must focus on improvements to the current rule that provide cost-effective risk reduction with minimal risk of unintended consequences or significant misallocation of scarce resources for individual homeowners, water systems, or the communities water systems serve.

Lead Service Lines

The most significant barriers to full lead service line replacement are (1) divided ownership / responsibility and (2) the cost of replacement. In drafting the rule revisions, EPA must recognize the limitations these two factors have on (1) the quality of data available to guide action, (2) allocation of the cost of replacement, and (3) the time required for all lead service lines to be fully removed. AWWA is actively engaging its members to foster advancing full lead service line replacement. EPA should avoid setting unrealistic regulatory expectations or creating bureaucratic obstacles to community-specific solutions.

[1] Note, the Six-Year lead concentration data reflects first-draw samples following at least a 6-hour period of stagnation. Samples are taken from homes that are prone to higher levels of lead, e.g., lead service line, older brass, and copper with lead solder plumbing.

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Create an Inventory

An important step in creating a future without lead in contact with drinking water rests on developing a sound understanding of the locations of lead service lines in communities. Having an inventory aids in developing a strategy for removing those lines during ongoing main replacement, service line repairs, home remodeling and sale, home rentals and focused outreach and engagement of households with lead services.

An exact inventory describing the use of lead pipes under both water utility and customer ownership is not feasible. At present, estimates of the number of lead service lines in community water systems in the United States range between 6.1 and 10 million. These lead service lines exist within a larger universe of service lines totaling 96.7 million. These estimates are imperfect, and there are anecdotal reports of underestimates and overestimates from individual systems. Where systems are excavating to identify lead service lines (currently being tested as a tool of last resort for confirming the presence of a lead service line), systems are noting that fewer than expected numbers of lead lines are found.

While research is ongoing, at present there is not an accepted field procedure for identifying if a service line is made of lead without physically seeing the whole line. This is important in several respects. These lines are very old and have been repaired; such repairs may have removed portions of an existing lead line. Also, if EPA includes lead goosenecks within the definition of lead service lines for purposes of an inventory, visual inspection requires digging down to the water main, which is often in the street. An exact inventory would necessitate certain knowledge about all 96.7 million service connections in the United States, not simply the 6.1–10 million that are more likely to be lead. Moreover, while lead service lines are typically measured in tens of feet in length, goosenecks are, by definition, typically less than 3 feet long (both Mueller and Hayes goosenecks were manufactured at lengths of 18, 24, 30 and 36 inches in length).[2, 3, 4]

An exact inventory is not, however, needed for the tasks at hand (i.e., guiding sampling efforts, targeting communication initiatives, preparation for construction activities, and tracking elimination of lead services). Therefore, it is important that inventory development move forward with the tools at hand, recognizing their weaknesses. Moreover, use of ongoing activities to improve the lead service line inventory can be framed as a win-win opportunity for such activities as automated meter reading installations, identification of gutter – stormwater connections, backflow prevention device inspection and other initiatives.

If EPA were to craft regulatory language requiring utilities to prepare lead service line inventories, the Agency would need to recognize several challenges:

1. Lead service lines were installed during the 1800s and early – mid 1900s. Consequently, the primary record of installed material selection, tap cards, are decades if not a century or more old. In subsequent years, there have been changes in practice that impact the fidelity of the data, loss of records, and unrecorded changes in installed materials as repairs and other construction have occurred.
2. Service lines are owned in part by the water system and in part by the customer in most communities. Customers do not always advise the water system of improvements to the portion of the service line the customer owns. In many communities, plumbers have not been an active

[2] Mueller Company. Catalog, November 1, 1961, p. 4-3.
[3] Hayes Water Service Products Catalog, p. 18.
[4] Lead Industries Association, Lead in Modern Plumbing, p. 8.

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stakeholder in lead service line identification, homeowner awareness or updating utility service line material records.

3. Not all community water systems are villages, towns, or cities where the water system service area is the same as a municipal subdivision. "Municipal" records used to compile an inventory (e.g., building and plumbing permits, tax records, mapping, etc.) will be harder to compile in rural areas served through public service authorities and areas served by investor-owned water companies). Even where the water system and municipal government are the same, there are often extra-territorial service areas where the water system is not able to rely on other municipal departments within the same government entity.
4. Absent the threat of loss of water service, water systems do not have the authority to require customers to cooperate in acquiring data about the service line material on the customer's property. Turning off water presents a health and public safety concern. There are also concerns about social inequity where water shutoffs disproportionately impact segments of a community's households.
5. While water system staff sometimes enter customer premises (e.g., to set or repair meters, respond to water quality complaints, etc.), such contact is minimized for the convenience of customers and for the safety of water system staff (e.g., need for a two-person crew and customer scheduling).
6. Systems are transitioning to new asset management platforms that will, over time, facilitate infrastructure renewal, including lead service line replacement. As EPA is aware from its own software platform transitions, these transitions can complicate data acquisition and present unanticipated challenges that effect timely delivery of expected products.
7. Current technologies used to examine service lines that are buried under yards, sidewalks, and streets requires excavation. Excavation only allows inspection of the exposed pipe length, is costly, and has its own associated risks including the integrity of service lines that are not lead and unnecessarily disturbed.

Given these limitations, it is important that EPA rule requirements and associated guidance set reasonable expectations that:

1. Allow the development of the initial inventory based on existing records, historical practice and utility field experience.
2. Provide sufficient time to allow the initial inventory to be developed, recognizing that in many communities, utilities will be supplementing in-house records with data from other departments and oftentimes other entities.
3. Expect that the inventory will be improved over time as additional information can be incorporated through ongoing water system activities (e.g., meter replacement, water quality visits, etc.) and community outreach (e.g., home inspections when buildings are sold, instructions to homeowners, plumbing permits).[5]
4. Expect that water systems will have practices in place to appropriately address previously unrecognized lead service lines when they are discovered.
5. Improve public information and education so that homeowners can be active stakeholders.
6. Utilize opportunities like the sanitary survey for the primacy agency to review the system's practices to maintain and improve the inventory.

[5] Example customer outreach, "Help us update our records," DC Water, Available 1/25/2018 at https://www.dcwater.com/servicemap.

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Public access to information, including the presence / absence of lead service lines, is important to advancing replacement and a natural part of public outreach. Rule requirements for public access should assist property owners without creating unintended harm. EPA may be contemplating a requirement that water systems make inventories publicly available (e.g., on the water utility website, through a database query, or other means). Data compiled by municipal water systems, including information on service lines on private property, may be subject to freedom of information requests. Investor-owned water systems are not necessarily subject to FOIA. Some systems have encountered legal concerns when considering releasing what can be viewed as private information.[6]

Since water systems do not typically own the whole service line and since it may be impossible to determine the material of the whole length of the line, water systems cannot make absolute, always-current statements about the status of a home's service line. Systems that provide a map or database that allows public searches of this data typically use a strong disclaimer statement to users.[7] Some have posed the idea of a state-based or national repository of service line material inventory. The above described data quality and liability considerations are similarly challenges to building such a repository. The burden on EPA, states, and water systems to develop and keep such a data system current warrants careful consideration. On first reflection, managing this data at the local level appears to be the more immediate opportunity for advancing lead service line replacement and educating customers.

FULL LEAD SERVICE LINE REPLACEMENT

Fully removing lead service lines will require a long-term, shared commitment. Water systems and their customers will not be able to replace lead service lines overnight. It will take time to complete a robust inventory, prioritize lead service line replacement among other water system improvements (and other non-water system needs in the community), and identify funding mechanisms to assist in payment for the work. Communities will need to navigate numerous legal and implementation challenges that require time and resources in the face of competing demands. Customers will face affordability challenges. Locally developed programs, responsive to local circumstances, will be essential, and shared federal and state support also will be necessary to facilitate fully removing lead services.

Reducing environmental exposures is a long-term, challenge that must address multiple paths of exposure. EPA has no means at present to understand if a community would benefit most by expanding its lead paint abatement program, targeting lead sources in rental housing, removing lead service lines, or pursuing other sources of lead. This point is best described by other participants in the federalism consultation. From the viewpoint of a water system, this balance must be struck locally so that the water system receives the support and coordination needed from all the partners it needs to effectively engage customers in full lead service line replacement.

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[6] Association of Metropolitan Water Agencies, State FOIA Laws: A Guide to Protecting Sensitive Water Security Information, July 2002, Available 1/25/2018 at https://deq.utah.gov/Permits/drinkingwater/docs/2014/07Jul/StateFOIA.pdf.

[7] Example disclaimer, "DISCLAIMER: The maps provided by the Boston Water and Sewer Commission (BWSC) are based on property surveys conducted during the installation of the Automated Meter Reading system, as well as information directly provided by customers and acquired during physical inspections. BWSC does not guarantee the accuracy of these records and maps, which shall be used for the sole purpose of providing property owners and residents with information regarding their private water services, and not for any commercial, legal or other use. These records will be updated on a monthly basis, or at such alternate times as BWSC designates. BWSC reserves the right to alter, amend or terminate at any time the display of these maps and records." Boston Water and Sewer Commission, Available 1/26/2018 at http://www.bwsc.org/COMMUNITY/lead/leadmaps.asp#TOP_PAGE.

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ANSI/AWWA C810-17, Replacement and Flushing of Lead Service Lines should be incorporated by reference as the protocol for lead service line replacement. AWWA developed a management standard for when a water system anticipates or incidentally encounters lead service lines in the course of construction.[8] This standard addresses identification of lead services, notification of impacted customers, and protective measures to reduce the potential for exposure to lead due to the replacement. As with all ANSI standards, C810-17 was developed by a committee selected with a balance of perspectives in mind and was made available for public comment. This standard will be reviewed periodically and improved based on system experience and new research. It is worthwhile to note, that "*The National Technology Transfer and Advancement Act of 1995 directs [federal] agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical.*"[9] EPA Region 5 has recommended the City of Flint, Michigan follow C810-17 when replacing lead service lines.

EPA should not make replacing all lead service lines in a specific timeframe a rule requirement. AWWA is actively urging its members to integrate lead service line replacement into their current distribution system operations and capital programs now, because it is going to take a substantial, long-term effort to replace the 6.1 – 10 million installed lead services. The NDWAC recommendation, which AWWA endorsed, recognized the challenges associated with setting a fixed deadline and focused on establishing strategies to move forward with available authorities and funding. AWWA is urging systems to start as soon as possible to work with the communities they serve to develop a local strategy and begin to fully remove lead service lines. These community-specific strategies consider local circumstances, particularly locally-appropriate approaches to shared responsibility for accomplishing full replacements. There are numerous potential strategies for funding full service line replacement; developing state and local policies to address this challenge of paying for full replacement will take time and solutions will need to be locally appropriate.[10]

In contemplating a timeframe for completing all lead service line replacements, it is important to look at the housing sector for the frequency with which opportunities to engage homeowners arise. Nationwide, approximately 5.4 million existing homes were sold in 2016, and a similar level of sales occurred in 2017.[11] In 2013 the National Association of Home Builders estimated that the typical buyer of a single-family home can be expected to stay in a home approximately 13 years.[12] It is also worth noting that 35% of households in the U.S. rent rather than own their home.[13] The U.S. Census tracks how frequently people move in the U.S. Looking at data from 2013 and 2014, 24.5% of all people living in renter-occupied housing units lived elsewhere one-year prior. [14] As expected, the Census data illustrates that renters move much more frequently than people in owner-occupied housing (roughly 5 times as often).

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[8] AWWA, ANSI/AWWA C810-17, Replacement and Flushing of Lead Service Lines, Available 1/26/2018 at https://www.awwa.org/store/productdetail.aspx?productid=65634922.

[9] EPA Website, Available 1/26/2018 at https://19january2017snapshot.epa.gov/data-standards/federal-national-and-international-data-standards_.html.

[10] Environmental Financial Advisory Board, Financing Lead Risk Reduction, October, 2017, Available 02/22/2018 at .

[11] Lawrence Yun, Residential Real Estate Economic Issues and Trends Forum at the REALTORS® Conference & Expo in Chicago, IL, November 3, 2017, Available 1/26/2018 at https://www.nar.realtor/presentations/november-2017-economic-housing-outlook-lawrence-yuns-presentation-slides .

[12] National Association of Home Builders, Latest Calculations Show Average Buyer Expected to Stay in a Home 13 Years, 2013.

[13] U.S. Census, 2016 American Community Survey, 1-Year Estimates, US Census Bureau. Updated 9/2017 (Note, 53% of households that live in rental housing rent structures with 4 or fewer units).

[14] U.S. Census, Press Release. U.S. Mover Rate Remains Stable at About 12 Percent Since 2008, Census Bureau Reports, January 2015. Available 02/21/2018 at https://www.census.gov/newsroom/press-releases/2015/cb15-47.html.

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The Census's mover rate for people living in owner-occupied housing units of 5.0 percent is also comparable to the HAHB typical expected stay statistic.

Opportunities to replace lead service lines require coordination with state and local government beyond the water department / separate utility associated with changes in housing and other events include:

1. Identification/confirmation and replacement at time of title transfer.
2. Identification/confirmation and replacement at as a condition of occupancy post vacancy.
3. Identification/confirmation and replacement prior to rental.
4. Identification/confirmation and replacement as a condition of water service (initial turn on for a new customer or return to service if there is lapse in service).
5. Identification/confirmation and replacement in conjunction with a major remodeling of a current structure.
6. Identification/confirmation and replacement in conjunction with main replacement.
7. Identification/confirmation and replacement rather than repair following a leak or break.
8. Integrating lead service line identification and removal into lead-free facility approval processes for businesses seeking an operating license (including childcare facilities).

The average useful life of water mains varies with the material, the method of manufacture, and the conditions where the pipe is installed.[15] The oldest cast iron mains are quite long-lived with average useful life of about 120 years, while cast iron from the 1920s is expected to fail 20 years more quickly, and pipes installed post-World War 2 are expected to last just 75 years.[16] What is important to note is that the rehabilitation and replacement of these mains is a demographic echo of their initial investment. Today, in 2018, water system capital programs are at the beginning of the resulting wave of capital infrastructure re-investment.[17]

Service lines have a finite useful life, and as older lines fail, there is an opportunity to replace them completely. Lead service lines frequently do not fail for decades, but since those lines were often installed more than 70 years ago, failures are increasingly likely.[18]

Another opportunity for lead service line identification and replacement exists when plumbers engage with homeowners for routine work. Hot water heaters, for example, have a useful life of 8 – 12 years,[19] and installing a new one typically involves a visit from a plumber.

Lead service line replacement programs entail:

1. Identifying and actively engaging homeowners with lead service lines to coordinate full lead service line replacement.
2. Actively coordinating with other utilities engaged in infrastructure renewal (e.g., wastewater, stormwater, electric, gas, telephone, cable, etc.).

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[15] AWWA, Buried No Longer: Confronting America's Water Infrastructure Challenge, 2012. Available 02/21/2018 at http://www.awwa.org/portals/0/files/legreg/documents/buriednolonger.pdf.
[16] AWWA, Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure. 2001.
[17] AWWA, Buried No Longer: Confronting America's Water Infrastructure Challenge, 2012. Available 02/21/2018 at http://www.awwa.org/portals/0/files/legreg/documents/buriednolonger.pdf.
[18] Lee, Juneseok; Meehan, Myles. Survival Analysis of US Water Service Lines Utilizing a Nationwide Failure Data Set. Journal AWWA, Vol. 109, Number 9: 13-21. September 2017.
[19] DOE, 2010 Water Heater Market Profile, U.S. Department of Energy. September 2010.

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3. Timing construction to reduce disturbing neighborhoods and respond to local policies that prohibit construction in recently repaved roads.[20, 21]
4. Doing service line replacements concurrent and preferably in coordination with other capital infrastructure investment (e.g., replacing mains that have high break rates, repairs to improve water quality or reduce water loss and maintain pressure etc.).
5. Replacing service lines as part of a community's efforts to revitalize its economy and jobs base (e.g., new or renovated facilities to deliver adequate water supply to new or expanding businesses).

If EPA evaluates lead service line replacement over a specific period of time, it must account for the cost and economic consequences of the timeframe selected. The shorter the period of time, the greater the burden associated with the above elements. There are also secondary impacts, including:

1. Increased failures of other infrastructure and consequent economic harm to the community as other necessary infrastructure improvements are delayed.
2. Disruption and potentially repeated and protracted disruption of neighborhoods and business districts as lead service line replacement would be occurring increasingly on a schedule separate from ongoing capital projects.
3. There is a practical limit as to how many streets can be disrupted in a community at any one time.
4. Larger numbers of households facing the prospect of immediately bearing the cost of replacing the portion of the service line they own. As a consequence, a larger number of households would not have access to financial assistance programs, given limited resources for these programs (or if assistance programs are expanded to meet the required pace, there would be an associated impact on fiscal health of the community).
5. Setting an arbitrary deadline of any length will be a disincentive to action in communities where the goal is unrealistically short given local circumstances, and also where a lengthy timeframe is not needed.

A recurring top concern in AWWA surveys of water sector leaders is the ability to convince ratepayers to fund infrastructure renewal and replacement.[22] An important aspect of building ratepayer trust is establishing a systematic process for prioritized infrastructure investments, or in other words, asset management.

It is also worthwhile to consider the overall management of drinking water infrastructure. EPA has described best practices for asset management as a core element of timely renewal of drinking water infrastructure.[23] An embedded tenet of asset management is the development of a system-specific path from the current state to the desired level of service, considering both the conditions of existing assets and the community's ability to find funding mechanisms -- particularly raising water rates.

One of the purposes of this consultation is to consider the unfunded mandate implications of the proposed rule. While EPA may identify some funding, such as through the state revolving loan fund, that can assist in replacing lead service lines, the demand for SRF funds is already larger than the available state and federal loan dollars. In 2017, total disbursements from state drinking water SRFs total less than

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[20] Sacramento County, Available 02/15/2018 at http://www.sacdot.com/Pages/Trenchingandroadcutmoratorium.aspx

[21] City of Portland, Available 02/15/2018 at https://www.portlandoregon.gov/article/437990.

[22] AWWA, 2017 State of the Water Industry Report. April 2017.

[23] EPA, Asset Management: A Best Practices Guide, April 2008, Available 1/26/2018 at https://www.epa.gov/sustainable-water-infrastructure/asset-management-water-and-wastewater-utilities.

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$3 billion dollars. So, if all SRF funds were applied to lead service line replacement without respect how much SRF funds were available in any one state vs another, it would take 10 – 16 years to replace the estimated 6.1 – 10 million lead service lines. Importantly, the SRF is almost always a loan, meaning that the households in a community ultimately pay for the lead service line replacement program, with associated interest.

None of the existing federal or state infrastructure funding programs (e.g., SDWA SRF, Community Development Block Grant, Rural Utility Service, etc.) are positioned to provide grant programs sufficient to meet the $30–50 billion expense often cited for replacing existing lead lines in their entirety.

PARTIAL LEAD SERVICE LINE REPLACEMENT

The current LCR requirement to conduct lead service line replacement should be removed.[24] The most important change with respect to lead service line replacement that EPA can make in the LCR revisions is to change the regulatory construct from punitive to one of building capacity. The current rule requirements replacing lead service lines at a time when corrosion control is either not in place or not optimal. The timeframe for action in this provision is such that partial replacements are an inevitable result. As previously stated, the LCR revisions should reflect the NDWAC recommendation that water systems develop a proactive replacement strategy and work with their communities and other partners to implement that strategy.

It is important that practice in the sector emphasize full lead service line replacement but recognize that partial replacement will occur. In developing AWWA C810-17, the consensus view was reached that it was possible to reduce the number of partial lead service line replacements but there are multiple scenarios where partial replacements will continue to occur, and remain in place for indeterminant periods of time. A few example situations include:

1. An after-hours repair that disturbs a lead service line (e.g., a main or service line repair that occurs outside of typical work hours so as to reduce disturbance to community, provide access to personnel or equipment, etc.).
2. An emergency repair that disturbs a lead service line (e.g., a main or service line repair where water leakage presents a hazard to life or property).
3. A lead service line is recognized during ongoing work and the affected property owner is not available to coordinate full replacement.
4. A partial replacement by a customer's plumber occurs and the water system must schedule and mobilize equipment to address the utility portion.
5. The customer's plumber must schedule or re-schedule replacement of the customer's portion of a lead service line.
6. A customer does not want to or cannot afford to participate in a full-lead service line replacement.

EPA should use the rulemaking to emphasize full lead service line replacement as a routine practice. In lieu of full replacement, there should be a record explaining that either (1) the customer was unwilling or unable to pursue full replacement or (2) the status of the pending actions that will ultimately lead to full replacement. When partial replacement occurs, there is an opportunity for recurring customer notification of the need to complete the lead service line replacement.

Water systems are not the only utilities with buried infrastructure. Electric, sewer, gas, cable, telephone, stormwater, and fiber lines are installed, repaired, and replaced by other utilities and their contractors.

[24] 40 CFR Part 141.84

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To the extent possible, utilities coordinate so that one does not harm the others installed assets. Water systems can provide other utilities with standard operating procedures for how to coordinate around lead service lines, but the rule should recognize that the water system has limited influence over other utilities and their contractors.

PITCHER FILTERS POST LEAD SERVICE LINE REPLACEMENT

A single-choice risk mitigation measure should not be written into regulation. No other federal SDWA regulation specifies a single-choice treatment option. This is a deliberate policy because situation-specific solutions are necessary. An apt comparison for pitcher filters is the specific risk mitigation used following a nitrate maximum contaminant level violation. While states will often advise the use of bottle water with such a violation, other options like the use of an RO device maybe a better solution for some households.

This observation applies equally to plumbed in POU devices.

Pitcher filters are only one of several risk reduction options after lead service line replacement. AWWA Standard C810-17 includes (1) flushing (i.e., running water through) the new or replaced service line immediately after installation, (2) flushing the water lines in the home, and (3) providing instructions to the occupant to flush taps used for drinking or cooking periodically. The standard also recognizes that some situations may warrant using point-of-use filters, or customers may desire to use POU filters.

A number of systems have distributed pitcher filters after either exceeding the lead action level or as part of lead service line replacement protocols. To-date, "maintenance" of the pitcher filters in these systems has been limited to provision of (1) instructions to the customer on POU use, (2) a supply of replacement filters for the pitcher, sufficient for the intended period of performance, and (3) a point-of-contact for assistance. The experience of systems with this level of maintenance and research by other systems considering providing pitcher filters have identified several challenges:

1. Confirming delivery of the pitcher to the intended recipient – When pitchers are left behind by field crews or delivered by third-party providers, there are instances of theft, failure to deliver, failure to deliver in a timely manner, and other issues one would associate with leaving a package on a doorstep.
2. Adequate supply of NSF certified devices – At times, the available supply of NSF-certified filter products has been limited. Surges in demand that are unanticipated by the available manufacturers can lead to shortages and delays in filter delivery to the water system (or fulfillment center) for subsequent delivery to customers.
3. Potential legal liability for failure of the customer to properly use the device – It is conceivable that claims could be brought against a water system if a customer failed to adequately maintain the pitcher filter and subsequently claimed an illness was attributable to the water from the pitcher.
4. Impact on household behavior – It is not clear to what degree households will take seriously a recommendation to use and properly maintain a pitcher filter.

Benefit of providing pitcher filters is no more certain than benefit from routine flushing. Based on EPA's comments, the use of a pitcher filter in this situation would not trigger current guidance for maintaining and guaranteeing the performance of pitcher filters as described by EPA guidance.[25] As with flushing,

[25] EPA, Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems, EPA 815-R-06-010, April 2006. Available 1/26/2018 at https://www.epa.gov/sites/production/files/2015-09/documents/guide_smallsystems_pou-poe_june6-2006.pdf.

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AWWA is not aware of any research demonstrating the effectiveness of pitcher filters reflecting actual customer behavior.

Introducing as regulatory requirement creates a new barrier to implementation. With respect to primacy agency oversight of such a requirement, a traceable record to demonstrate delivery of pitchers within the specific criteria included in the rule language would be required. A regulatory requirement to provide filters, therefore, has the unintended impact of creating a new set of bureaucratic requirements that are a distraction and barrier to timely situation-specific risk mitigation.

The Water Research Foundation is currently sponsoring research into managing lead in drinking water and related issues.[26] This research agenda includes an ongoing effort to better understand flushing protocols around lead service line replacement

1. WRF # 4584, Evaluation of Flushing to Reduce Lead Levels and
2. WRF # 4713, Full Lead Service Line Replacement Guidance.[27, 28]

AWWA's standard review process will consider the information from these projects in the regular review and updating of AWWA Standard C810-17.

COST OF LEAD SERVICE LINE REPLACEMENT

EPA's proposed estimate, $4,700 per individual lead service line replacement, is too low.[29] There is substantial system-to-system and home-to-home variability in the cost of lead service line replacement. Replacement cost includes two components. The first is the administrative infrastructure (e.g., personnel time, business systems and field work) to identify and engage individual customers in lead service line replacement. As water systems make these systems more customer-focused, the cost of this administrative infrastructure rises. Engagement during a replacement may include dialogue with both a property owner and a resident, both of whom have a role throughout the preparation, execution and follow-through on a service line replacement. Water systems do not typically track administrative costs in a manner that supports quantifying administrative infrastructure. One partial example is the lead service line replacement program oversight contract for Flint, Michigan's ongoing program. Available program data from the 2017 Flint replacement program puts the administrative cost per service line removed at roughly $760.[30] Preliminary data presented by Denver Water in November 2017 on its lead service line replacement program suggests that the administrative cost per service line removed is approximately $600.[31] These two estimates illustrate (1) that administrative is a significant element of replacement program cost that must be considered, (2) there is program-to-program variability due to program structure, elements, and maturity, (3) best estimates at present are imperfect and likely underestimate actual program start-up costs and financial burden on departments beyond the water utility, and (4)

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[26] WRF, Lead and Copper Corrosion: An Overview of WRF Research, October 2017, Available 1/26/2018 at http://www.waterrf.org/resources/StateOfTheScienceReports/LeadCorrosion.pdf.

[27] WRF, Evaluation of Flushing to Reduce Lead Levels, Available 1/26/2018 at http://www.waterrf.org/Pages/Projects.aspx?PID=4584.

[28] WRF, Full Lead Service Line Replacement Guidance, Available 1/26/2018 at http://www.waterrf.org/Pages/Projects.aspx?PID=4713.

[29] EPA, Presentation to Federalism Consultation, January 8, 2018, Available 02/22/2018 at https://www.epa.gov/dwstandardsregulations/icr-federalism-consultation.

[30] Mlive, Flint lead pipe replacement program to switch hands in 2018, December 1, 2017. Available 02/22/2018 at http://www.mlive.com/news/flint/index.ssf/2017/12/flint_lead_pipe_replacement_pr.html.

[31] Price, Steve, From 0 to 60,000: Denver Water Gets a Leadfoot, AWWA, Water Quality Technology Conference, November 2017.

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current estimates represent "low hanging fruit" of easy replacements. Over time, remaining lead service lines will entail increasingly costly outreach and coordination.

The second component is the cost of replacing the lead service. This latter cost is what is typically reported, and the cost per replacement varies based on many factors including:

1. Steps that can be taken to reduce mobilization cost (e.g., integrate into a larger construction project, execute in a systematic program, utilize existing crews during other operations and maintenance tasks).
2. Level of collaboration with customer (e.g., the number of field teams required to complete the entire replacement rather than coordination among multiple teams, including the customer's plumber and electrician, involved).
3. Site-specific constraints (e.g., the built environment in which the replacement is occurring)

Looking just at the field work costs associated with lead service line replacement, $4,700 is likely a low estimate (see Figure 1).[32] When estimating the cost of field work, EPA needs to be sure the estimates capture:

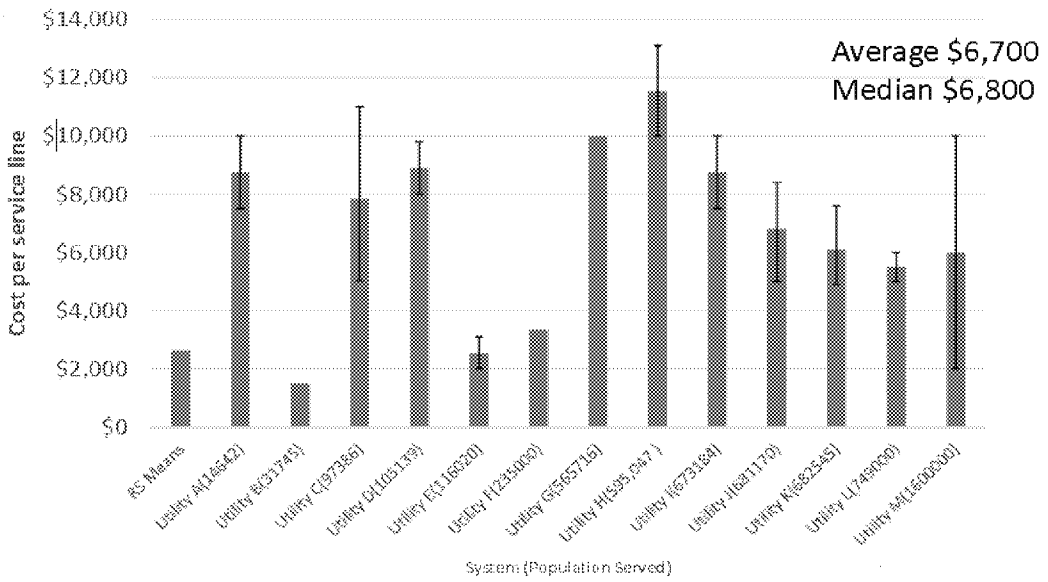

Figure 1 – Cost of full lead service line replacement fieldwork[33]

1. Both the replacement of the water system and the customer owned portions of the service line (these values may be tracked separately),
2. Mobilization costs, as well as time and materials costs, while on site at a specific house, and
3. Troublesome replacement and ideal replacement scenarios.

[32] AWWA, Ongoing data collection effort. Data as of 02/22/2018 reflecting information from 14 community water systems.
[33] Ibid.

Corrosion Control

The NDWAC recommendations could form the basis for LT-LCR revisions with respect to improving corrosion control practice. Today, under the current LCR, all systems may not install "optimized corrosion control" but all systems implement practices that reduce corrosion. The specific practices on which EPA and the sector rely when active corrosion control treatment for lead is needed are (1) pH and alkalinity adjustment and (2) phosphate addition. The current regulatory framework requires these specific treatments at systems that serve more than 50,000 persons and smaller systems that exceed the action level. When revising the LCR EPA should acknowledge that thousands of systems have made choices that reliably maintain 90th percentile lead levels below 15 µg/L. Systems are, in fact, taking corrosivity into account:

1. When selecting water sources,
2. In selecting treatment processes,
3. In making changes to water chemistry during treatment or adjusting treatment practice, and
4. Through the application of corrosion inhibitors and sequestration agents.

The rule framework and guidance should recognize the connections between distribution system operation and maintenance practices and corrosion control benefits, e.g., managing water age, lining of cast iron mains, unidirectional flushing programs, maintaining water quality in finished water storage, flushing stagnant water, etc. These and other practices contribute to limiting conditions that exacerbate corrosivity and complicate chemical corrosion control treatment.

It is important to incentivize sound practices for maintaining distribution system water quality and infrastructure. The NDWAC recommendations recognized that it was important for water systems to more explicitly explore how current practice was impacting corrosion control for lead and to use that information to improve corrosion control over time. This is in contrast with a regulatory model that focuses on either regulatory bright lines or treatment requirements rather than considering the underlying principles behind the regulatory requirements. The following NDWAC recommendations for improving corrosion control should form the basis for LT-LCR revisions, in which:

1. Corrosion control remain a central water system responsibility under the LCR.

2. Water quality parameter monitoring is expanded to include more frequent monitoring and monitoring at a more extensive set of locations, by integrating water quality parameter monitoring with monitoring in the distribution system for other regulations.

   While WQPs cannot predict the lead level at the tap, this is not their primary purpose. A water system sets WQPs to guide operational practices that produce water quality conditions which minimize corrosivity. Monitoring WQPs is used to ensure the system is operating within those target conditions. As with any process control strategy, there should be an ongoing feedback loop through which the system evaluates the data collected and continues to refine its performance.

3. Statistical control charts of WQP data are used for analysis to inform target conditions.[34, 35]

4. Improving and refining WQP parameter selection and target conditions should be supported by special studies to understand system-specific factors influencing corrosion control (e.g., stability

[34] Cornwell, David; Brown, Richard; McTigue, Nancy, Controlling Lead and Copper Rule Water Quality Parameters, Journal AWWA Vol. 107:2 p. E86-E96, http://dx.doi.org/10.5942/jawwa.2015.107.0011.
[35] AWWA, Manual 58. Internal Corrosion Control in Water Distribution Systems, Second Edition, 2017.

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of existing scales, impact of historical sequestering agent use, corrosion of existing materials of construction, etc.).

The NDWAC framework also provides a viable strategy for advancing corrosion control practice among smaller and consecutive water systems.

SYSTEMS TARGETED TO INSTALL AND OPTIMIZE CORROSION CONTROL

The framework should focus first on improvement of systems that are only marginally compliant to fully evaluate and address gaps in their corrosion control practices. EPA's question might be restated to ask, "Which systems warrant the most attention now, as we revise the LCR?" A regulatory framework is not efficient if it focuses on systems which are already reliably compliant in documenting and enhancing their corrosion control practices.

SYSTEM SIZE THRESHOLD

NDWAC's proposed approach to improving corrosion control offers a viable path for expanding corrosion control to all systems over time. The NDWAC recommendation was intended, in AWWA's view, to overcome the primary barriers associated with increasing expectations on small systems. The NDWAC proposal focused on actions that:

1. Are based in known science and sound water system practice,
2. Utilize data streams that are readily acquired with available staff and expertise,
3. Foster use of good process control practice and improvements in technology available to small systems at an affordable cost,
4. Provide system-specific information that the system and state can utilize to make changes over time, and
5. Provide a vehicle to build awareness and practice in systems of all sizes around ensuring consistent water quality for all customers.

If EPA pursues a definition of corrosion control that emphasizes installation of active corrosion control treatment, then the Agency will need to stage rule implementation around primacy agencies' ability to manage the large number of small systems that would need to modify treatment. There currently are less than 1,000 water systems serving more than 50,000 persons; in total there are 10,600 systems of all sizes with optimized corrosion control under the current LCR.[36] In contrast, there are more than 5,700 medium-sized systems (population served between 3,300 and 10,000) without optimized corrosion control treatment, and roughly 63,600 smaller systems subject to the LCR that do not have optimized corrosion control treatment, e.g., a total of 69,300 systems that would need to develop and install OCCT per the rule requirements.[37] While some small systems are in suburban areas, many of these small systems serve rural communities.

Typical Agency practice follows one of several approaches:

1. An across-the-board requirement applied equally to all systems at the same time, typically three years after promulgation with the potential for a two-year extension for capital construction if approved by the primacy agency.
2. An across-the-board requirement, with implementation beginning with larger systems and moving over time to smaller system size categories.

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[36] EPA, Analysis of Impacts of Corrosion Control Treatment on Lead and Copper Levels over Time, (prepared by Cadmus Group; provided to NDWAC Workgroup), July 2010.
[37] Ibid.

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3. A requirement limited to sizes or a combination of sizes and types of systems.
4. Triggered action, where monitoring is conducted and systems that exceed a trigger then initiate evaluation steps or proceed to installing treatment.

Variances are available under all the above approaches. However, as a practical matter, they are used infrequently. When they are used, they have the effect of adding workload on state primacy programs and complicating communication with customers in the impacted service area.

Treatment technique requirements should be appropriate to the type of public water system. AWWA's comments are primarily focused on community water systems, but the current LCR also applies to nontransient, noncommunity water systems. EPA could distinguish between CWSs and NTNCWSs (approximately, 17,800 NTNCWSs serve less than 10,000 persons) with respect to corrosion control / treatment technique compliance options. CWSs are most often responsible for delivering water to a customer, whose plumbing system contributes the lead that ultimate reaches the drinking water tap. In contrast, all potable water piping and fixtures associated with an NTNCWSs are owned by the same entity. "Appropriate" should also take ease of implementation into account. Drinking water is an ancillary activity for NTNCWSs and consequently few have dedicated staff that are expert in operating water treatment, consequently complex treatment that requires close attention is not a sound compliance option for these systems.

Oversight of Corrosion Control Optimization

Current OCCT decision-making framework is not feasible for state primacy agencies to oversee if applicable to all small systems. As noted previously, optimized corrosion control is defined as a few chemical treatments, and when framed as such, corrosion control treatment changes require extensive evaluation, time, resources and state oversight. Currently, EPA is recommending a year or longer pipe loop study to support installation of a new corrosion control treatment.[38] Under an "across-the-board requirement" regulatory approach, systems of all sizes would require state approval of the following within a three to five-year time window:

1. Identify a preliminary set of corrosion control options (e.g., combinations of pH, alkalinity, phosphate dose, etc.),
2. Develop a pilot loop test plan,
3. Execute the pipe loop test plan,
4. Develop a summary report and recommendations,
5. Conduct an evaluation of potential for unintended impacts as currently required by the LCR,
6. Develop test plans/recommendations to respond to impacts on system operation, particularly compliance with other regulatory requirements,
7. Prepare necessary plans and specifications for construction,
8. Engage in necessary public outreach around the treatment changes, construction, financing, etc.
9. Identify and obtain necessary funding,
10. Develop a test plan for new treatment start-up,
11. Execute the start-up test plan, maintain routine communication with state throughout, and adjust treatment to fix issues identified during start-up,
12. Prepare final as-builts and operations plan.

[38] EPA, Correspondence from Bryce Feighner to Karen Weaver, February, 2017, Available 1/26/2018 at https://www.epa.gov/sites/production/files/2017-02/documents/letter_to_honorable_karen_weaver_and_bryce_feighner_regarding_city_of_fl_0.pdf.

It is reasonable to expect that accomplishing these steps will require substantial training and state engagement directly with smaller systems. A query of the most recent posting of SDWIS found more than 6,300 substantive violations related direct to installation and operation of OCCT.[39] Less than 3% of those violations were associated with large systems; the largest group of violations were associated with very small systems (<3,300 persons served) – both community and noncommunity water systems. These violations suggest that the level of state oversight required for applying the current OCCT decision-making process to thousands of small systems will overwhelm state primacy agencies.

LEAD SERVICE LINES AS TARGET FOR CORROSION CONTROL

Corrosion control has been demonstrated to be effective reducing soluble lead. AWWA has sought input from experts in the field of corrosion control on several occasions to assess whether phosphate addition or pH/alkalinity adjustment would reliably control particulate lead. As recently as November 2017, the response has been that there is not a body of data supporting this conclusion.[40] EPA staff have acknowledged this point. Therefore, targeting water systems with lead service lines in order to control particulate lead is not appropriate.

Because corrosion control is well documented as a means of controlling soluble lead and, thereby, reducing elevated lead levels, EPA might prioritize systems based on the distribution of observed lead levels or consistency of system performance relative to the action level. Such a prioritization approach could inform the pace of state-system engagement on corrosion control described above using the NDWAC framework.

PLUMBED IN POINT-OF-USE DEVICES

Requiring water systems to install and maintain POU devices in customers' homes is not a viable regulatory option for addressing lead from lead service lines in community water systems. There are implementation considerations associated with utilizing plumbed-in POU devices beyond the burden imposed by the standard of performance described in EPA Guidance for SDWA compliance by installing POU devices. [41] They include:

1. Inability to gain access to 100% of homes with lead service lines to install, maintain and monitor filter performance.
2. Liability for harm to customer's property when installing devices (a frequent anticipated risk when installing POU devices on existing faucets and countertops).
3. Personnel safety when installing, maintaining and monitoring filter performance.
4. Inability to assure coordination with customer and consistent, adequate maintenance of the installed device.

Water systems do not own or maintain any plumbing components on customer property that entail as frequent entry into the home for maintenance as POU devices. Such entry presents both coordination challenges and risk to utility personnel.

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[39] EPA, Safe Drinking Water Act Information System, Available 1/26/2018 at https://ofmpub.epa.gov/apex/sfdw/f?p=108:9:::NO::P9_REPORT:VIO.

[40] AWWA, AWWA Expert Workshop-Sampling Fit for Purpose / Corrosion Control Treatment Going Forward, Washington, DC, November 12-13, 2017.

[41] EPA, Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems, EPA 815-R-06-010, April 2006. Available 1/26/2018 at https://www.epa.gov/sites/production/files/2015-09/documents/guide_smallsystems_pou-poe_june6-2006.pdf.

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A single-choice risk mitigation measure should not be written into regulation. No other federal SDWA regulation specifies a single-choice treatment option.

Installed POU devices are only a viable solution when the number of homes being treated is small and the inhabitants cooperate. As noted previously, EPA guidance for the use of POU devices describes a standard of care that includes proper selection and installation, ongoing maintenance and regular monitoring of performance. Historically, EPA has recognized that this treatment strategy was not a cost-effective risk reduction strategy compared to centralized treatment, other than for very small communities.

In Flint, Michigan, there was an extensive installed POU program. The teams responsible for outreach to customers on POU operation and performance were not able to access a significant number of homes for follow-up visits once the devices were installed. In March 2017, the program manager for the Flint outreach effort characterized the situation as follows:

> *"To date, CORE teams have attempted nearly 84,000 visits and connected with around 24,000 residents. We want to get that number up," Weaver said. "Our goal is for CORE workers to connect with a resident at every home in the city. We know some residents are leery about opening their doors to people they don't know, so we asked the workers and the CORE program director, Paul Newman, a long-time Flint resident himself, to come today so residents can see who they are and learn more about what it is they have been hired to do."*[42]

The City of Flint website hosts a video describing this extensive community-based outreach program, the challenges they see implementing the program, and the steps they are taking to overcome them. This program is an exceptionally strong outreach effort; the lack of customer engagement is not due to a lack of effort by the program.[43] Recently, Flint Neighbors United released a survey of Flint households capturing household understanding of POU devices, including maintenance. The survey illustrates that even with a substantial program to provide and support installation of POU devices, 15% of homes that responded to the survey (282 of 1,894 responses) did not have an installed POU. More than 9% of respondents with installed filters appear to not be maintaining the filter correctly. There is a separate question in the survey on when lead in tap water was most recently tested at respondent's homes; roughly 21% had not been tested in the last year.

The CORE program employed 160 field workers and 16 supervisors at hourly wages of $10 and $12 respectively, plus benefits.[44] This amounts to a personnel cost, plus estimated overhead cost of $8,985,600 per year. Assuming each of the 43,000 homes with active accounts in Flint received one filter and 3 replacement cartridges each year ($20 each) the cost for the filters per year is $3,440,000. An estimated annual cost for the CORE program is over $12.4 Million. While a remarkable, community-based effort supported by substantial state and federal subsidies (subsidies, which are unlikely to be available to other community water systems), the Flint POU program would not meet the requirements of EPA's current guidance for SDWA compliance using an installed POU program.

Requiring the water system to install and maintain a POU device to address a defect resulting in whole or in part by the property owner is not sound public policy. Mandatory installation of installed POU devices

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[42] City of Flint Press Release, March 22, 2017, Available 2/16/2018 at https://www.cityofflint.com/2017/03/22/video-released-to-inform-flint-residents-about-core-program-and-workers/.

[43] Ibid.

[44] Mlive.com, Officials say they want Flint residents to fill 160 water crisis jobs, 12/3/2016, Available 02/21/2018 at http://www.mlive.com/news/flint/index.ssf/2016/12/officials_looking_for_flint_re.html.

on taps in buildings would be an unwise national precedent that would have far-reaching consequences well beyond lead.

Optimal Corrosion Control

A DEFAULT CORROSION CONTROL TREATMENT

Water chemistry and pipe materials differ among water systems, so corrosion control strategies must be system-specific. As a practical matter, if EPA establishes a one-size-fits all default corrosion control treatment requirement, that will be the installed treatment. Few if any water systems will be able to successfully demonstrate "equivalent" treatment in the eyes of state regulators or regional EPA staff. One can look at a lack of innovation in both primary disinfection and filtration practice as examples of how conservatively primacy agencies will view a default corrosion control treatment strategy.

EPA has not described what a default corrosion control treatment might be. Most previous EPA statements about a default corrosion control treatment have been based on data reflecting soluble lead levels and limited consideration of particulate lead release.

For community water systems in the United States, corrosion control is more complex than simply complying with the LCR. Systems must:

1. Balance water qualities from multiple water sources,
2. Manage corrosivity to protect buried infrastructure,
3. Anticipate corrosive water impacts on a variety of materials in building plumbing,
4. Provide a stable water quality for industrial, manufacturing, and commercial, as well as residential uses,
5. Reduce the potential for scales interfering with system and plumbing component operation,
6. Reduce exposure to unwanted aesthetic issues such as iron and manganese, and
7. Collaborating with receiving wastewater treatment authorities with respect to the contribution of phosphate and metals reaching publicly owned treatment works.

Regulatory requirements must be achievable while all other aspects of water system operations are realized.

CONSEQUENCES FOR RECEIVING WASTEWATER SYSTEMS

The Office of Water cannot develop SDWA and CWA policies that are in conflict. Mandating the use of phosphorus for corrosion control and requiring elevated doses will have local consequences. At present, where phosphate is used for corrosion control in the U.S., it contributes 10–35% percent of the phosphorus loading to the wastewater treatment facility (based on 10 drinking water–wastewater system pairs).[45] As phosphorus limits become more stringent, the use of phosphate becomes not only a cost consideration for the wastewater treatment facility, but equally importantly, an issue of credibility in the relationship between the utilities and local governing bodies. As more communities partner to achieve economies of scale in water and wastewater service provision, the number of governing bodies impacted by this credibility dynamic also grows, further complicating efforts to develop regional partnerships.

For decades EPA has identified nutrient pollution as a significant challenge for natural water bodies and phosphate as a nutrient of concern for inland water, particularly lakes. Over the past two years EPA has emphasized nutrient control as a key tool in preventing harmful algal blooms, including blooms that

[45] Rodgers, Impact of Corrosion Control on Publicly Owned Treatment Works Water Quality Technology Conference, New Orleans, LA. 2014.

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produce cyanotoxins. In 2016 EPA released health advisories for microcystins and cylindrospermopsin. When levels of these toxins are elevated in drinking water, the water system is expected to issue a "do not consume" order, which has significant implications for the community served by that water system. When evaluating the cost implications of phosphate addition on wastewater treatment plants, phosphate corrosion inhibitor addition leads to an incremental increase in wastewater treatment cost. It can also result in some wastewater treatment facilities facing a "cost wall" because it triggers a shift to a new wastewater treatment train design.

Currently, EPA's ATTAINS database indicates that almost 2 million acres of lakes and 55,000 miles of rivers and streams are impaired by phosphorus alone.[46] EPA estimates that by 2020, half of the states will have numeric nutrient water quality criteria for phosphorus under the Clean Water Act.[47] In addition to developing statewide nutrient criteria, EPA is working with states to develop practice around "interpreting" narrative nutrient criteria to set loading limits for nutrients.[48] Implementation of this latter effort appears to be proceeding even more rapidly than state adoption of statewide numeric nutrient criteria. It seems likely that this tension between the addition of phosphate and subsequent removal will only become more frequent with time and will take place where both the water system and wastewater treatment system are both attempting to make ever smaller marginal improvements in performance. Impacts on wastewater discharges is a constraint that should factor into optimized corrosion control treatment selection.

EXPECTATIONS MUST HAVE SOUND PREMISE

Benchtop and pipe loop studies are informative but not perfect predictors of full-scale success. Data from benchtop and pipe loop studies is a key tool in guiding corrosion control, but these test systems are not sufficiently accurate in their predictions as to fine tune corrosion control based on this data alone. Further research is needed to better relate test system results to full-scale performance and to understand variances in test data when interpreting full scale application.

More research with actual pipe scale formation is needed to justify high, sustained levels of phosphate addition. The principle justification for higher orthophosphate levels are solubility curves for a lead phosphate compound. Those curves for required orthophosphate dose are generally a function of an alkalinity (or inorganic carbon). The curves show that at higher alkalinity levels that orthophosphate doses of 1 mg/L as P (3 mg/L as PO_4) or above may be needed. While useful guidance, solubility curves do not fully describe the electrochemical reactions or coatings involved in corrosion. In fact, often the compound modeled is not often found in pipe scales.

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[46] EPA, National Summary of State Information, Available 02/15/2018 at https://ofmpub.epa.gov/waters10/attains_index.control#causes.

[47] EPA, State Progress Toward Developing Numeric Nutrient Water Quality Criteria for Nitrogen and Phosphorus, Available 02/15/2018 at https://www.epa.gov/nutrient-policy-data/state-progress-toward-developing-numeric-nutrient-water-quality-criteria.

[48] 2013, Correspondence Chris Hornback to Nancy Stoner, March 7, 2013. Available 2/15/2018 at https://www.nacwa.org/docs/default-source/default-document-library/letter-to-n-stoner-on-narrative-nutrient-criteria-3_2013.pdf?sfvrsn=0.

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Although this analysis is preliminary, we are finding that the solubility models in common use overestimate the amount of phosphate needed. For example, the graph in Figure 2 shows the solubility curves often cited and the data points are from actual lead coupons at steady state.[49] As seen, inorganic carbon values in the mid-range of around 20 mg C/L fall close to the curve for a dissolved inorganic carbon of 5 mg C/L while the data for the DIC of 15 mg C/L is actually below the curve for a DIC of 5 mg C/L. These results are not surprising given experience in the field but point out a difficulty with making decisions for the rule (e.g., the necessity of high orthophosphate doses) and individual treatment decisions based largely on an understanding of corrosion based on the available solubility curves.

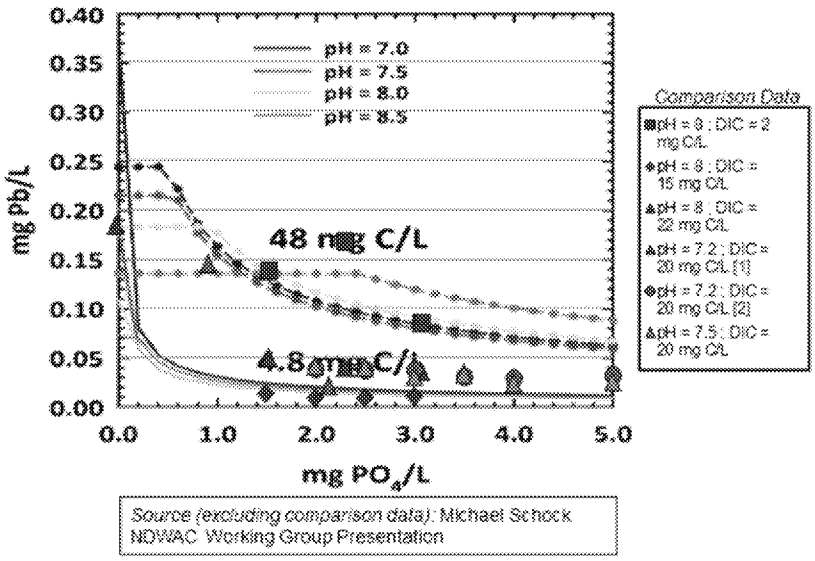

Figure 2: Theoretical lead solubility curves compared to benchtop tests using actual pipe materials.

The above example is not novel. Much earlier work came to a similar conclusion using a different methodology.[50] As Edwards et al. points out, other factors can have system-specific relevance. This point can also be extended to include the over use of corrosion control indices. Generalized corrosion control models are an important aspect of managing scaling and initial evaluations of water stability, but, alone, they are not sufficient to guide adjusting corrosion control.[51]

REFERENCING PRACTICE IN UNITED KINGDOM

EPA cannot reference guidance for treatment in the United Kingdom without a complete understanding of actual practice. The view that elevated phosphate doses (e.g., 1.3 - 2 mg/L as P [4 – 6 mg/L as PO_4] or higher) are critical to effectively manage lead often cites corrosion control practice in the United Kingdom. Unlike the United States, the bulk of the U.K. is served by 12 water companies. After contacting water systems and U.K.-based drinking water treatment consultants, there is good reason to believe that

[49] Cornwell Engineering Group, Personal correspondence February 14, 2018.

[50] Edwards, Marc; Jacobs, Sara; Dodrill, Donna. Desktop Guidance for Mitigating Pb and Cu Corrosion By-Products. Journal AWWA Vol. 91, Num. 5. P. 66-77. https://www.awwa.org/publications/journal-awwa/abstract/articleid/14051.aspx.

[51] Hill, Christopher. Importance of Corrosion Indices and How to Use Them. Water Quality Technology Conference, 2017.

the levels of phosphate applied in the U.K. are not as different from those currently used in the U.S. as typically described. Our survey efforts are not complete, but to-date, it seems that as an ongoing target, systems tend to focus on 1 mg/L as P (3 mg/L as PO_4), though the target can range from 0.4 – 1.5 mg/L as P (1.2 – 4.6 mg/L as PO_4) on a site-specific basis. Observations to-date emphasize the use of orthophosphate over other forms of phosphate primarily based on cost considerations. This is not markedly different from the range of orthophosphate addition here in the U.S. 0.2 – 1.0 mg/L as P (0.5 – 3.0 mg/L as PO_4).

PERIODIC RE-EVALUATION OF CORROSION CONTROL

Corrosion control has and should continue to evolve based on science and field experience. The NDWAC recommended a periodic re-evaluation of corrosion control as a mechanism to respond to new knowledge acquired through research and practice. As a practical matter, AWWA has a Manual of Practice for Internal Corrosion Control in Water Distribution Systems.[52] That manual is updated periodically to reflect new developments. Like AWWA standards, it is developed through a consensus process, but it is not an ANSI document. Historically, EPA has revised guidance relevant to the LCR, and that guidance has been considered by states and systems (e.g., guidance published in 1992, 1995, 1999, 2001, 2003, 2007, and 2016.)[53]

One of the underlying tenets of corrosion control is a commitment to and consistent execution of a strategy. If EPA were to expect systems to re-evaluate current corrosion control practice periodically with an affirmative decision by the State that the system is using the appropriate strategy, then that state review must:

1. Be grounded in a sound understanding of corrosion control,
2. Consider sufficient system-specific information to facilitate sound decision making,
3. Lead to changes in practice when there are substantial opportunities for additional reductions in observed lead release, and
4. Include explicit consideration of unintended consequences from change.

Because changing corrosion control should be done carefully. The revised LCR should incentivize water systems to continually evaluate corrosion control rather than focus on rote regulatory compliance.

Sanitary surveys could serve as a mechanism for periodic review of corrosion control practice. All public water systems are required to have period sanitary surveys. For community water systems, these reviews must occur at least once every three years. These regularly occurring reviews of system practices, could include a review of ongoing corrosion control. And, as with other items evaluated in the sanitary survey, the primacy agency could identify potential revisions to evaluate and initiate as warranted based on a more substantive evaluation, necessary consultation, and appropriate permitting.

SUSTAINABLE OPERATIONS

In costing corrosion control, EPA needs to recognize the need for additional changes in treatment that are triggered by substantial changes in corrosion control. "Optimized corrosion control treatment" is a phrase that EPA appears to be preparing to re-define in the LT-LCR. EPA and state interpretation of the current rule allow for the considerations beyond simply reducing lead and copper concentrations. That same

[52] AWWA, M58 Internal Corrosion Control in Water Distribution Systems, Second Edition, 2017.
[53] EPA, Compliance Guidance Documents available 1/26/2018 at https://www.epa.gov/dwreginfo/lead-and-copper-rule#additional-resources.

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flexibility is necessary in the LT-LCR. Examples of additional considerations in EPA's most recent guidance include:

1. "black or red water complaints due to oxidation of iron and manganese in the distribution system"[54]
2. "potential to form scales on the interior of piping systems that may reduce the effective diameter of the pipes, resulting in loss of hydraulic capacity and increases in system headloss and operational costs"[55]
3. "disinfection performance and compliance with Surface Water Treatment Rules and possibly the Ground Water Rule"[56]
4. "raising the pH and DIC may cause calcium carbonate to precipitate in the distribution system, clogging hot water heaters and producing cloudy water.[57]
5. "... there are limitations to their application. Two factors that could limit the use of phosphate-based corrosion inhibitors are (1) reactions with aluminum, and (2) impacts on wastewater treatment plants."[58]

Recognizing considerations beyond regulatory compliance when selecting optimal corrosion control treatment for a system is critical to the sustainability of community water system efforts to reliably assure water quality within a matrix of multiple objectives, and simultaneous efforts to maintain and improve system performance on multiple topics.

Reliable supply of affordable treatment chemicals required. Phosphate addition is a treatment strategy that, if pursued, must be maintained into the future. At present phosphate is an international commodity for which the primary sources are off-shore and dependent on unencumbered trade.[59] There are mines in the United States, but the principal sources from a global perspective are Morocco and China.[60, 61] Water systems only account for a small fraction of phosphate use in the United States (about 3%); the most significant use and international driver for commodity pricing is agricultural applications, which is not only a much larger use but also a less challenging product to deliver.[62] While currently there are not any shortages in supply, drinking water systems have seen periods of dramatic price increases in phosphate and some supply disruptions at individual utilities.[63] For example, a survey of 47 U.S. water systems found that these systems experienced an average phosphoric acid cost increase of 233% over the period from January 2008 to January 2009.[64]

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[54] EPA, OCCT Evaluation Technical Recommendations for Primacy Agencies and Public Water Systems, EPA 816-B-16-003, March 2016, p. 19.
[55] Ibid, p. 19.
[56] Ibid, p. 41.
[57] Ibid, p. 42.
[58] Ibid, p. 43.
[59] SEI, Sustainable Use of Phosphorus, October 2010.
[60] IFDC, World Phosphate Rock Reserves and Resources, 2010.
[61] USGS, Mineral Commodity Summaries 2017, Available 1/26/2018 at https://minerals.usgs.gov/minerals/pubs/mcs/2017/mcs2017.pdf.
[62] WRF, Supply of Critical Drinking Water and Wastewater Treatment Chemicals – A White Paper for Understanding Recent Chemical Price Increases and Shortages, 2009.
[63] Ibid
[64] Ibid

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CONSECUTIVE SYSTEMS

Consecutive systems will bear costs of change to corrosion control practice as well as the wholesaler installing treatment. In organizing cost consequences for the LT-LCR, EPA faces a challenge like that presented by the disinfection byproducts and ground water rules. There are substantial dependencies between water wholesalers and consecutive systems. While each public water system (each PWSID) "stands alone" with respect to compliance, decisions made to optimize corrosion control for one system may or may not be the most cost-effective solution for other systems in the same extended network due to differences in home construction materials, condition of distribution systems, water age, and other factors. "Optimizing" for reducing lead and copper must be balanced across this extended network of systems on a local basis. Consequently, not only should the rule provide the necessary flexibility, but the Agency's economic analysis should reflect the associated costs for preliminary analysis, treatment, transition preparation, monitoring, customer outreach and oversight.

FINDING AND FIXING PROBLEMS IN CORROSION CONTROL

Exceeding community action level should trigger assessment and correction. One aspect of the current rule that has proved problematic is that systems that exceed the action level are triggered into a long list of action items. This list includes preliminary evaluation of corrosion control treatment. It appears that, at least in some instances, this lengthy process provides a window for the system to return to lead levels below the action level without having to complete an evaluation of corrosion control changes and make necessary corrections. The NDWAC recommendation that if investigation is triggered by the rule, then the evaluation should be fully completed, and the lessons learned be applied in corrective actions.

The details of the rule are important. The trigger for system-level evaluation and correction may exist separate from triggers for evaluation / additional support to individual homeowners who experience elevated lead levels. This concept of find-and-fix could be tied to system-specific water quality parameter monitoring plans, which are based on distribution system and water treatment process control monitoring. These plans would utilize statistical process control strategies to flag deviations that warrant investigation and corrective steps. It could also be triggered by multiple in-home tap samples exceeding a community "action level."

The framework utilized in the Revised Total Coliform Rule for assessment and correction of sanitary defects provides a useful parallel to find-and-fix under the LT-LCR. As with the RTCR, the process would begin with in-home sampling triggering a tiered response that first focuses on levels of lead in the structure, and based on the data, expands to include evaluation of system-wide issues.

Public Education

EPA should provide resources to support public outreach on lead risk and lead risk mitigation. Water systems should actively and transparently communicate with their customers, particularly customers with lead service lines, about lead risks and steps households can take to evaluate and reduce lead in drinking water. The NDWAC recommendations include development of a comprehensive resource to support communication with the public about lead and lead risk mitigation across all environmental exposures. Households need clear, holistic guidance on how to identify and reduce lead risks from all environmental exposures. Communicating to the public that lead risks need to be addressed and require action, while also helping the public recognize the timeframes and limitations of environmental exposure reduction strategies is a challenging task. Well-grounded and consistent communication materials that reflects the best information from CDC and other authoritative sources, is necessary to support revision of the LCR.

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TARGETED OUTREACH TO CUSTOMERS WITH LEAD SERVICE LINES

Outreach to customers with lead service lines will need to use multiple delivery channels appropriate to that community as part of an ongoing communication program. The challenges associated with targeted outreach vary as a function of existing data systems, customer communication infrastructure, nature of the system's service area and customer behavior. Consequently, the NDWAC recommends the use of a comprehensive ongoing communication program. Some of the challenges of outreach targeted to customers with lead service line include:

1. Organizing outreach so that it reaches customers who are prepared to act, e.g., at the time of home purchase, when a home inspection report is available, when a new homebuyer is reviewing needed improvements. Unfortunately, the water system will not start a relationship with the new customer with respect to that address until after transfer of title.
2. Utilizing existing delivery mechanisms like bill stuffers, consumer confidence reports, and similar routine communication tools requires messaging that recognizes most customers do not have lead service lines.
3. Targeted messaging around lead service lines has two audiences: those who live in the home and those who own the home. Due to rentals and other housing situations, the primary point of contact for the water system may be different from the individuals in the home. Therefore, messages related to removing lead service lines may reach the appropriate individual but information about taking protective measures may not reach inhabitants.

NOTIFICATION OF EXCEEDING ACTION LEVEL

Notification under the WIIN Action should be to individual homes at which the water system has data that lead levels are elevated. EPA is required by the WIIN Act to address public notice. The WIIN Act does not have any accompanying report language that informs how to interpret its provisions, but it is clear from the resulting edits to SDWA that the 24-hour timeframe is limited to instances when there is a "potential to have serious adverse effects on human health as a result of short-term exposure."[65] This criterion is not consistent with the basis for the current LCR action level (i.e., communitywide 90th percentile concentration greater than 15 µg/L). It is not clear how EPA will utilize the ongoing analysis to identify a level of lead in water consistent with a short-term exposure scenario. Regardless of level, the implications of a 24-hour notification requirement include the following:

1. Ongoing water system public education programs about lead, currently only required of water systems that have exceeded the lead action level, will be necessary to provide context for households that receive this notice recommending immediate action, if such notices are to be impactful.
2. Water systems will need support from both state and local health experts to communicate the health effects of short-term exposures to lead and the appropriate action steps to take.

An alternative approach would be to focus on communicating with individual homes when observed lead concentrations are above the action level (i.e., homes in the compliance sample pool must be notified of elevated lead levels). This interpretation of the WIIN Act revisions would facilitate more targeted dialogue with occupants regarding observed lead levels in their home; a potentially more effective conversation.

Regardless of the numeric value of the action level, the implementation challenges include:

[65] SDWA, Sec. 1414(c)(2)(C)

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1. An administrative burden on meeting notification requirement (e.g., assuring notice is provided, documenting successful notification, and backstopping primary mode of notification) limits when systems can take samples, thus prioritizing notification over collecting data in a timely or informative manner.
2. Need for additional administrative procedures, systems, and personnel to assure notice in time frame is achieved.
3. Close coordination with local public health staff with expertise in lead risk communication. Such coordination can be challenging in communities where the water and health departments exist within the same governing structure; it becomes increasingly difficult with separation in governance: e.g.,
    a. County health department, with town or village operated community water system,
    b. County or state health department with subdivision community water system,
    c. County subdivision with rural community water system owned or operated by a third-party provider (non-profit, cooperative, or investor-owned entity).
4. Notification by priority mail may not be possible within 24-hour timeframe, necessitating state acceptance of phone contact, email or other electronic media notification to affected households.
5. Rural and suburban communities have less access to priority mail delivery services requiring additional personnel hours to backstop documented delivery of required notice.
6. Administrative expectation for documenting notification limits the tools available for notification (e.g., a phone call, text message, or drive by interaction with customer absent further documentation may not suffice for regulatory compliance) and requires administrative systems and personnel time.

PUBLIC ACCESS TO INFORMATION

Results from In-Home Tap Sampling

Data should be readily available to the public without revealing exact address where sample was drawn. Tap samples need to be drawn by residents to (1) assist the water system with compliance monitoring, (2) assist the water system in evaluating potential changes in treatment and (3) inform households of potential risks and protective actions. However, making data from sampling available to the public and connecting it to a specific structure may dissuade homeowners from collecting samples. Making all data from sampling available to the public is challenging, because the protocols for sampling may vary and lead to results that should not be compared directly. In Flint, individual addresses were revealed, but in presenting the data, considerable effort was taken to segregate it into comparable datasets.[66] It was necessary to (1) present pre-POU and post-POU data independently, (2) show compliance data monitoring separately, and (3) not present some data (for example, to-date lead service line profile data has not been presented in a readily accessible format).

Currently individual tap sample results are available to the public upon request. Beyond a local interest in transparency, the federal Freedom of Information Act as well as state and local policies require information release by publicly-owned water systems. Investor-owned water systems may have less certain legal requirements for release of information. In states where water systems submit individual LCR sample results, the data from all water systems is available through FOIA of the state program. What is often not made available under current practice is the exact street addresses associated with individual

[66] State of Michigan, Taking Action on Flint Water website, Available 2/1/2018 at http://www.michigan.gov/flintwater/0,6092,7-345-76292_76294_76297---,00.html.

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sample results. This is primarily due to homeowner privacy concerns, and the need to recruit customers to participate in compliance monitoring.

EPA indicates it will be implementing PRIME in 2018. PRIME has been described as a vehicle for public access to individual observations submitted in compliance monitoring. It is not clear when EPA intends to fully implement PRIME in this manner. Currently, not all states maintain a Safe Drinking Water Information System record of actual observed lead values. In either a state or federal public data access strategy, the regulatory community would not only need to acquire and upload the data in a timely fashion, but it would also need to determine if the Agency (EPA or state) would take responsibility for publicizing lead and copper observations associated with particular addresses (e.g., privacy concerns, liability for imperfect data being presented, etc.).

Water systems currently summarize LCR compliance data in consumer confidence reports. CCRs are already viewed as dense technical documents by many members of the public, and adding tens to hundreds of individual lead observations would be at odds with ongoing efforts to improve them.

Water systems or states could make compliance monitoring data available through local websites, as the State of Michigan did and continues to do for Flint. Michigan posted both tabular data and maps of observed lead levels. EPA could engage Michigan to determine how much the state invested in developing and maintain public access to lead data through that website. It is worth noting that not all smaller water systems maintain a website or have access to the website for their local jurisdictions.

One of the failings of the current LCR is it may discourage sampling by the water system to facilitate diagnosis of water quality problems, particularly lead issues, in individual homes. Systems that take samples that:

1. Meet the general criteria for compliance data may be added to the compliance dataset by the State, even if multiple samples are from the same structure during an investigation of that structure.
2. Do not meet the criteria for use as compliance data, are expected to be judged by some as being deliberately drawn in an effort to misrepresent or hide lead occurrence.
3. Do not have a robust chain of custody and quality assurance prior to acceptance by the laboratory for analysis, can be added by the state into a system's compliance dataset.

Under the current rule, a few samples lead to (1) aggressive public education systemwide and (2) revisiting the fundamentals of corrosion control practice. Neither are insignificant challenges for a water system, hence an inability to directly assist individual homeowners. If the rule mandates public access to non-compliance data, then the rule will further discourage testing for lead by water systems and efforts by water systems to effectively engage customers.

Water Quality Parameter Monitoring

Providing the public WQP data should not be allowed to become a barrier to water systems expanding WQP monitoring. Water systems frequently provide basic information to customers, including generalized WQP data. This is data the public does find useful when caring for aquariums, deciding to install home treatment devices, planning the design of commercial / industrial process equipment, and other applications.

It is not clear what WQP data EPA anticipates providing to the public as a regulatory requirement. WQP monitoring as required by the current rule is infrequent and limited to a few locations. Providing the currently required data to the public in summary form would be feasible, particularly where the system has a website. This data as well as more frequent monitoring of relevant parameters are submitted to

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the state in regular reports. The submitted data is available to the public currently through FOIA of the state or local water system. There are potentially security concerns with releasing detailed process control data to the public (e.g., ongoing chlorine concentrations if oxidation reduction potential was a WQP, etc.), so the provision of enhanced WQP monitoring as described by NDWAC may present challenges.

Other barriers and cost considerations that EPA will need to consider:

1. There is an opportunity to expand use of on-line monitoring devices, but
    a. Data from on-line instruments must be handled appropriately, with appropriate quality control and quality assurance prior to use by the water system or provision to the public.
    b. Presenting on-line monitoring to the public complicates the primary goal of increasing use of on-line devices for process control by placing an administrative focus on public access rather than utilization of the data stream.
    c. Effective use of on-line instrumentation for process control, regulatory triggers, and public awareness requires a commitment to instrument maintenance that is significantly higher than what might be employed for an initial demonstration of capability or a short-duration research project.
2. If WQPs (grab sample or on-line) are provided to the public, then information must be provided to illustrate the relevance of the data. Simply providing a data point at a given time and location is not informative unless one has a clear notion of what portion of the service area that data represents. Modelling and analysis necessary to present WQP data to the public in a manner that is informative to individual households would distract from the initial goal of gaining more understanding and control of WQPs in the distribution system.
3. Providing basic information to the public requires effective risk communication. Consumers face an array of do-it-yourself home treatment device options and ongoing news stories of studies and advocacy reports. In the absence of a cohesive public communication effort about what WQP data means, there is ample opportunity for consumers to misunderstand the implications of the data to which they would now have access.
4. Each of the above considerations has an associated cost component to overcoming.

Tap Sampling

The revised LCR should incentivize sampling and special studies to better understand corrosion control and make informed decisions about treatment changes.

Dramatic changes to the current in-home tap sample protocol will substantially delay revision of the LCR. The current sampling protocol is not consistent with modern standards for quality laboratory systems (e.g., inadequate chain-of-custody procedures, inability to know if samplers are employing proper sampling technique, and consequently lack of legal defensibility for the compliance laboratory).[67] Consequently, there is interest in changing the sampling protocol to address the current failings. Moving away from customer collected samples is not likely if the rule revision:

1. Continues to use the current LCR sample protocol (or an alternative stagnation sample),
2. Revises the sampling protocol to target water from the lead service line, or
3. Increases the number of required samples required and thus requiring access to more customers' kitchen taps to obtain the requisite number of samples.

[67] EPA, Manual Certification of Laboratories Analyzing Drinking Water 5th edition, Available 2/2/2018 at https://www.epa.gov/dwlabcert/laboratory-certification-manual-drinking-water.

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If the purpose of compliance monitoring is solely to inform residents of lead levels at their taps, then these concerns are less troubling.

If the purpose of the sampling is consistent with the current LCR -- to trigger re-evaluation or installation of corrosion control treatment -- AWWA is not aware of any peer-reviewed studies to show how a new sampling protocol/increased sample pool would compare to the current protocol/sample pool.

EPA must clearly describe any required tap sample protocol. Samplers should be able to follow any tap sample monitoring and the protocol should be sufficient to eliminate "gaming" and forestall accusations of gaming sample results.

CURRENT SAMPLE PROTOCOL

Retaining current sample protocol as recently refined by EPA, may be the most expeditious option for EPA to pursue. The current sampling protocol, first liter following at least 6 hours stagnation, data has served community water systems well as a tool to reduce lead levels. The reductions in lead levels over the years has been well documented.[68]

Many water systems have been able to adjust their corrosion control program by assessing historical first liter samples. The sample procedure allows the system to compare data collected consistently over time and spatially because the samples are always collected the same way. Specific instructions bring some uniformity to the data facilitating this comparison. Multiple rounds of monitoring over time provides a historical benchmark for future actions. This historical data allows systems to spot changes either positive or negative and to make appropriate actions. Comparisons are relatively easily made between systems within a state when regulators want to make relative assessments of lead release across systems with similar water qualities.

First liter samples have also served to alert systems to major upsets. For example, the Flint 90th percentiles for first liter samples went over 100 µg/L. As orthophosphate and other WQ controls went into pace the improvements in first liter samples could be tracked and improvements seen as the 90th levels dropped to the current 6 µg/L level. A similar recognition, response, and downward trend occurred when Washington DC experienced elevated lead levels following its transition to chloramines.

While the first liter sample may not be the highest lead level found in samples from homes with lead lines, many homes and many cities do not have lead lines. Homes can still experience lead due to old brass, galvanized plumbing and lead solder. The first liter sample is actually very useful for sampling interior sources of lead.

Tap sample protocol representative of exposure

The current LCR sample protocol is not designed to be representative of exposure. Representing exposure will required more than changing when customers draw a one-liter sample. "Exposure" for risk assessment purposes occurs at three levels: individual, building and community. EPA has not provided information to understand which of these types of "exposure" this sampling framework would address. Consequently, it is not clear what combination of sample protocol, sample number, sample site location, and sample frequency the Agency is considering. As EPA considers presenting an LT-LCR monitoring plan as representative of exposure, it should:

[68] Richard A. Brown, Nancy E. Mctigue, And David A. Cornwell, Strategies for assessing optimized corrosion control treatment of lead and copper, Journal AWWA Vol. 105 No. 5 pages 62 – 75, May 2013.

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1. Appropriately match the sampling requirements to the objective for the monitoring (e.g., a sample to inform customers about lead levels in their water should be geared toward taking a sample of water likely to be consumed).
2. Clearly present how the data would be used in the regulation in a manner consistent with SDWA (e.g., not create a duty on community water systems that is beyond the bounds of water system ownership).
3. Identify opportunities to shift the new compliance monitoring requirement to one that can be executed by trained technicians within the framework outlined by EPA's laboratory certification guidance.

AWWA is not aware of any new guidance from EPA or others to provide insights into how sampling at a structure can best inform risk reduction steps by homeowners or landlords.

Households sample when consuming water

AWWA is reluctant to comment on a single aspect of tap sampling monitoring in isolation. Instructing consumers to take a tap sample when they are preparing food or getting a drink of water could substantially alter the LCR routine compliance monitoring dataset by reducing the period of stagnation prior to sampling.

It is not clear from EPA's comments how changing the sampling protocol in this way would be accompanied by other considerations in the rule revision:

1. How large an increase in the sample pool size to "make up for" the lack of certainty in minimum stagnation period?
2. A change in the actual protocol (e.g., is a first-draw, one-liter sample anticipated)?
3. A change in the households targeted for sampling (e.g., all homes in pool being homes with lead service lines)?
4. A single sample for lead and copper observations?
5. A change in the evaluation metric (e.g., 90th percentile value of 15 µg/L)?
6. A change in the implications of exceeding the evaluation metric?

All these considerations are relevant to the effectiveness of the compliance monitoring regime. Consequently, AWWA is reluctant to comment on a single aspect of monitoring. If EPA proceeds with evaluating this option, it is important for the Agency to communicate to the public:

1. That lead levels vary and a single observation from a tap does not adequately represent exposure to that household.
2. A community-wide assessment of lead levels does not mean that homes with lead sources (e.g., old brass fixtures, lead service lines, lead solder, etc.) will not observe higher levels, even if the LCR monitoring program is biased toward more challenging homes.

While communication around the current LCR sampling protocol is very challenging, there are similar challenges associated with this sampling protocol:

1. Risk management by the household should occur regardless of observed value in water and include basic steps to mitigate risk from other exposures (e.g., dust, paint, etc.)
2. The water system is taking steps to manage the corrosivity of the water, but absent removal of all sources of lead in contact with water, some risk remains.

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LOCATION OF TAP SAMPLES

Tap sampling and the questions of number, location, frequency and protocols all stem from the purpose of sampling required under the rule. There are several acknowledged uses for tap samples:

1. As a check on the need for / adequacy of corrosion control treatment,
2. Understanding the nature of lead release in a system to inform improvements to corrosion control, and
3. To inform / motivate customer action.

There is general agreement that no one sampling strategy and protocol is ideal for all three of these objectives.

There is also broad agreement that sampling for copper at locations identified solely to maximize the opportunity to find elevated lead levels is unlikely to recognize higher copper levels that can be associated with very new structures containing copper plumbing.

Each of the specific sampling strategies about which EPA requested input represent a balance among competing objectives for mandatory compliance monitoring. When evaluating any of these approaches, it is important to realize:

1. Intra-structure variability in observed lead levels can be substantial—observed lead levels vary as a function of water use patterns in the structure and other factors,
2. Inter-structure variability is also observed -- lead levels vary as a function of plumbing materials used, workmanship of that installation, presence of water treatment devices, and other factors, and
3. Variability of samplers contributes to cumulative variability in dataset – the degree samplers adhere to protocols.

Homes with Lead Solder

Eliminate date range criteria in current rule for homes with lead solder that may be included in in-home tap sample pool. The current LCR specifies sampling from Tier 1 homes followed by Tier 2 and Tier 3 homes. To be in Tier 1 and 2, the home must either have a lead service line or "copper pipes with lead solder installed after 1982 (but before the effective date of your State's lead ban)."69 Tier 3 homes must have solder installed before 1983. These date ranges are now more than 35 years old and their use is no longer consistent with the underlying logic for their inclusion in the rule.

Customer Requested Tap Samples

Customers should have access to reliable sources of tap samples. Water systems can provide this service or direct customers to reliable laboratories. At present, there are entrepreneurs offering water tests that provide inadequate results. These tests could lead customers to make poor decisions and waste money. EPA should provide clear national guidance for consumers on analytical methods and laboratories with appropriate skills and processes to provide reliable lead test results.

Customers are not requesting samples to understand corrosion control. They are interested in questions about their exposure and their plumbing. EPA should prepare a guide for fit-for-purpose sampling to inform households and assist water systems communicate with their customers.

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[69] EPA, Lead and Copper Rule Monitoring and Reporting Guidance for Public Water Systems: EPA 816-R-10-004, March 2010.

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Tap Samples at Schools

The Lead Contamination Control Act is an existing statute that directs the management of lead in schools. The LCCA "*Directs each State to establish a program, within nine months of this Act's enactment, to assist LEAs* [local education agencies] *in testing for, and remedying, lead contamination in school drinking water from coolers and from other sources of lead contamination. Requires that testing results be made available for public inspection in LEA administrative offices.*"[70] EPA has developed extensive guidance to schools on lead in schools.[71] But, the EPA website indicates that currently "*There is no federal law requiring testing of drinking water in schools and childcare facilities, except for those that have and/or operate their own public water system …*"[72] The website does not provide a basis for this last statement.

If EPA were to modify the LCR to require monitoring of lead in schools, it would have to (1) describe the purpose for the sampling, (2) the sampling program required to achieve that purpose, and (3) the responsible party for that sampling program.

With respect to these three tasks before the Agency:

1. Community water systems will not be able to use the data acquired through sampling in school buildings as a useful gauge for managing system-wide corrosion control. Rather, sampling in schools is an opportunity to (1) identify fixtures that warrant active flushing or replacement, (2) assess the success of in-building / in-campus water quality management, and (3) gather information to provide for parents, students, and staff.
2. Taking a single sample from a school is not informative and, importantly, can be misleading. For this reason, the current EPA guidance outlines testing of all outlets in a school in a prioritized fashion and follow-up sampling to facilitate diagnosis and remediation. The purpose and utility of such sampling is much different from SDWA compliance sampling.
3. Most school buildings are large, and consequently, they are very unlikely to have lead service lines. Therefore, it seems unnecessary to include school structures in a water system's LCR sampling pool.
4. As schools are large buildings, their inclusion in the sample pool raises the question of what sampling protocol is appropriate, further complicating rule implementation and data analysis.
5. "Schools" is not limited to public schools. It includes private and religious schools of all sizes, financial stability, staffing levels, and instructional setting (e.g., owned or rented space, stand-alone or integrated into another structure, etc.).

EPA should update its guidance on managing lead in schools as part of its support for schools. Given the likely use of the data, it seems the responsible party for monitoring will be schools. This has implication for (1) preparedness of school staff and contractors, (2) development of state primacy agency systems to track school compliance, and (3) school budgets.

It is important to note that individual states have initiated monitoring for lead in schools and in most instances, have decided to focus on sampling initiatives for schools and/or childcare facilities through direct oversight of the schools. States are taking a number of different approaches that best fit their circumstances. Recent examples include California, Illinois, Massachusetts, New Jersey, New York, Utah,

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[70] Summary: H.R.4939 — 100th Congress (1987-1988), Available 2/2/2018 at https://www.congress.gov/bill/100th-congress/house-bill/4939.

[71] EPA, Lead in Drinking Water in Schools and Childcare Facilities, Available 2/2/2018 at https://www.epa.gov/dwreginfo/lead-drinking-water-schools-and-childcare-facilities.

[72] Ibid

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and Washington.[73, 74, 75, 76, 77, 78, 79] None of the approaches initiated include sampling in schools as a component of LCR compliance monitoring.

NUMBER OF TAP SAMPLES

If EPA anticipates changing compliance monitoring, including increasing the number of tap samples required, it will need to communicate how the increased monitoring will advance the health risk reduction.
The sampling burden even under triennial monitoring is significant. These data represent only "compliance" samples and do not include observations from:

1. Special studies to inform corrosion control practice,
2. Lead service line replacement, or
3. Customer assistance samples.

Anecdotal reports and AWWA members' experience are that:

1. Small system waivers are available to systems with fewer than 3,300 persons, but these waivers are seldom granted.
2. Many community water systems are now on triennial monitoring, though some states like New Jersey have re-emphasized LCR monitoring and instituted a new round of annual monitoring in 2017.[80]

The NDWAC advised improvement of corrosion control would be best achieved through more water quality parameter monitoring both at the water treatment plant(s) and in the distribution system, rather than modifying the sampling protocol. Recent EPA compliance assistance has emphasized the role of special studies to improve system/state understanding of lead release in order to evaluate changes in water treatment or water supply. The WRF has funded research to better understand observed lead release after lead service line replacement, and the utility of monitoring in that specific context.[81]

Household action level

EPA has not demonstrated that it is able to undertake the required task based on the available information.
The NDWAC recommended development of a household action level. The presentation of EPA's analysis and the peer-review comments illustrate that developing a household action level continues to be challenging for the Agency (see Appendix A). It is clear EPA is finding it difficult to set a level that is consistent with the NDWAC recommendations, e.g., a level of lead in water that warrants action by a

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[73] 2017. California. Available 2/15/2018 at https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/leadsamplinginschools.html.
[74] 2017. Illinois Public Act 99-0922. Available 2/15/2018 at http://www.dph.illinois.gov/content/school-water-testing.
[75] 2016. Massachusetts. Available 2/15/2018 at http://www.mass.gov/eea/agencies/massdep/water/drinking/lead-and-copper-in-school-drinking-water-sampling-results.html.
[76] 2016. New Jersey State Board of Education. Available 2/15/2018 at http://www.state.nj.us/education/lead/.
[77] 2016. New York Department of Health. Available 2/15/2018 at https://www.governor.ny.gov/sites/governor.ny.gov/files/atoms/files/LeadTestingRegs.pdf.
[78] 2017. Utah. Available 2/15/2018 at https://deq.utah.gov/Compliance/compliance/drinkingwater/lead-copper-rule/lead-sampling-in-schools.htm.
[79] 2016. Washington, Governor's Directive on Lead, 16-06 Department of Health Recommendations. Available 2/15/2018 at https://www.doh.wa.gov/CommunityandEnvironment/DrinkingWater/Contaminants/LeadinSchools.
[80] PROVIDE CITATION
[81] WRF, Evaluation of Flushing to Reduce Lead Levels – 4584, Project progress can be tracked at http://www.waterrf.org/Pages/Projects.aspx?PID=4584.

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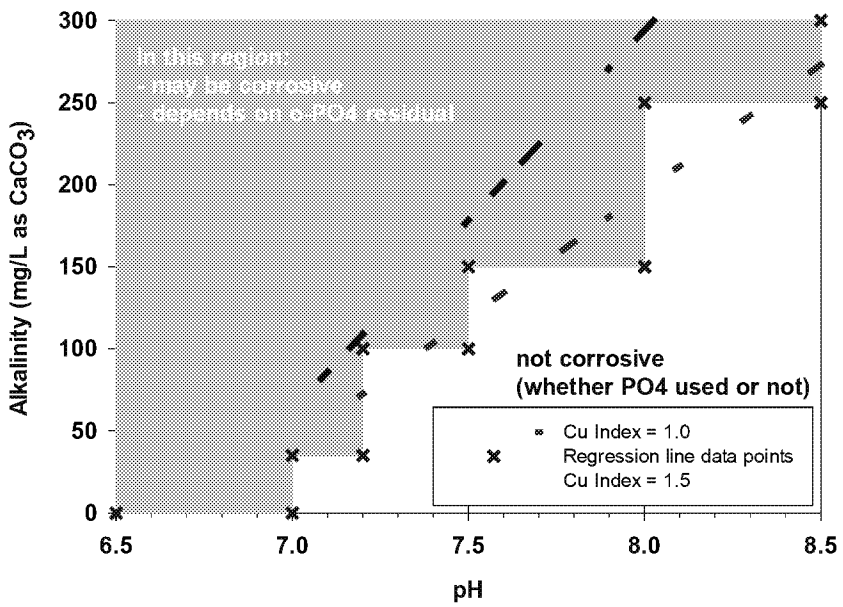
specific home above and beyond ongoing protective measures (i.e., corrosion control, lead service line replacement or other actions already being taken by home owner). While our societal goal is and should continue to be no exposure to lead, as a practical matter, parents and landlords need to know when lead levels in water represent an elevated risk to households, especially children. In the absence of a sound EPA analysis, using of "zero," "detectable lead," or a number below the community-wide action level as a household action level is not consistent with the balance of the LCR framework.

Copper

SCREEN FOR WATER AGGRESSIVE TO COPPER

Basing rule on a screen for water aggressive to copper will require different criteria than those proposed by NDWAC. During the NDWAC process, a preliminary classification of what water qualities would be corrosive to copper was developed with the idea that EPA would finalize the classification. Two preliminary classification charts were developed, one for strictly pH and alkalinity and one for systems using orthophosphate. The idea was that if a utility was classified as non-corrosive to copper, it would be relieved of many regulatory testing and sampling requirements. It was anticipated that most systems would be classified as non-corrosive to copper.

Figure 3 shows an example of the corrosivity classification that was developed for NDWAC. All pH and alkalinity combinations to the right of the shaded area would not be corrosive to copper. This figure also provides a basis for a simple index to determine a specific water quality's corrosiveness. The index is shown below the figure with any values having a Cu index < 1 being corrosive.



Note: Cu Index > 1 is defined as conducive to copper corrosion; For pH <7, water is corrosive to copper (irrespective of alkalinity); Cu Index = Alkalinity/regression = Alk/((A × pH) - b); A = 154.17 mg/L as CaCO3 / pH; b = 1,037.3 mg/L as CaCO3

Figure 3: Copper corrosivity index

AWWA conducted a survey of utilities to obtain water quality data and estimate the number of systems that would be classified as corrosive to copper. [82] The survey found that at the point of entry to the distribution system 50% of all systems (groundwater and surface water) and 70% of ground water systems surveyed would be classified, using the index, as corrosive to copper. That seemed like a large percentage and somewhat unrealistic since the U.S. generally does not have widespread copper problems. There was some concern if the survey was accurate.

Recently, the U.S. Geological Survey collected data on well water quality throughout the U.S. [83] The data base was for private and public wells. There was sufficient water quality data collected to allow calculation of the copper corrosion index for the wells. Figure 4 is a map by EPA region showing the results for the percentage of utilities on GW that are corrosive to copper according to the index as compared to the USGS results. The two are quite comparable. As seen in Table 1 by population size and totals, the overall U.S. corrosivity to copper by the survey was 70% and by USGS data it was 79%. Note that the survey is based on point-of-entry or distribution system and therefore represents treated groundwater, while the USGS data is raw well water. Treatment did not appear to alter the percentage significantly.

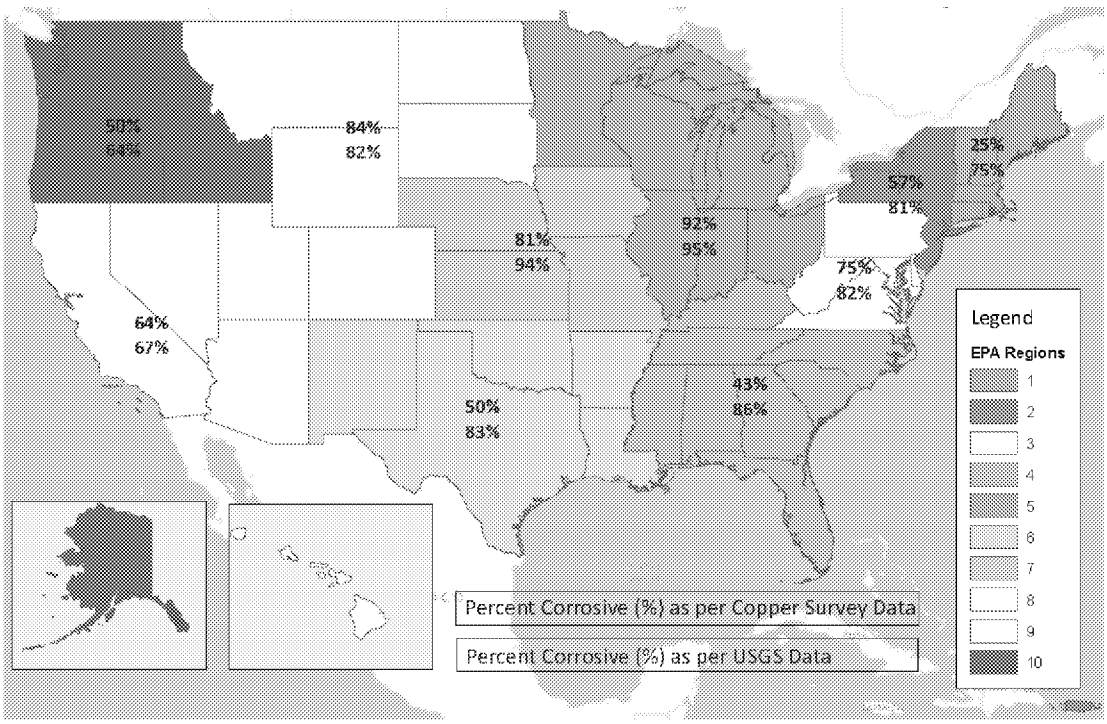


Figure 4: Groundwater Corrosive to Copper Using NDWAC Criteria (from Roth et al. and an analysis of data underlying USGS

[82] Roth et al., Copper Corrosion Under the Lead and Copper Rule Long-Term Revisions, Journal AWWA, April 2016, http://dx.doi.org/10.5942/jawwa.2016.108.0062.

[83] Belitz, Kenneth, Jurgens, B.C., and Johnson, T.D., 2016, Potential corrosivity of untreated groundwater in the United States: U.S. Geological Survey Scientific Investigations Report 2016–5092, 16 p., http://dx.doi.org/10.3133/sir20165092.

Population Class	Percent Corrosive (Cu - Index)			
	<10K	10-50K	>50K	Total
	Impact of PO_4 not included			
Cu Survey - POE	80%	56%	48%	71%
Cu Survey - DS	78%	53%	45%	69%
USGS				79%

Table 1: Percent Corrosive per Population Class for Copper Survey and USGS Data

The Roth et al. and USGS data raise an important question: "Is the NDWAC corrosivity classification correct, since it is not realistic that this many systems are experiencing high levels of copper?" The index is based on the solubility of Cu(II) for either cupric hydroxide or malachite. While solubility diagrams can be important in understanding reactions and interactions, they do not model the electrochemical reactions of corrosion or the scales that form on the pipe and reduce further copper release. Although preliminary in nature, a database on copper levels from fresh copper in various water qualities offers insight into utility of making decisions based solely on the current classification approach. Figure 5 is an example of two results. The smooth curves are the solubility values, and the two orange boxes are the experimental data. The experiment giving a copper level of 0.14 mg/L would be predicted to result in copper of about 5 mg/L, and the 0.09 data point would be predicted to be about 1.2 mg/L. Additional work will be needed to fully develop a reliable indicator of copper corrosivity, but it may be the current approach based on available solubility curves is overestimating potential copper levels.

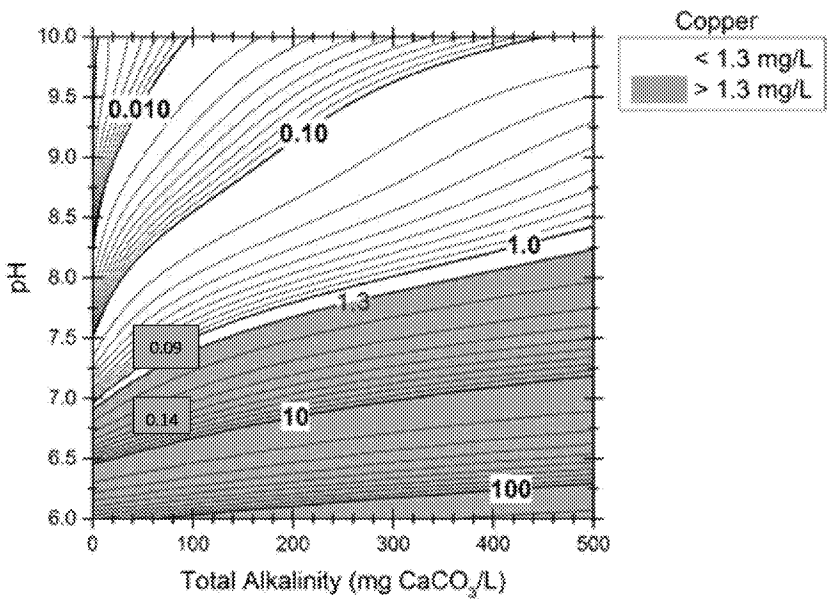


Figure 5: Theoretical copper solubility diagram with overlaid observations

While the USGS analysis suggests that the most corrosive ground waters are limited to the southeastern U.S., Mid-Atlantic and New England, the NDWAC criteria would classify the overwhelming majority of groundwater systems in all regions of the U.S. as corrosive to copper. Also, roughly 40% of systems that are corrosive in the Roth et al. were already applying phosphate and still considered corrosive, according to the NDWAC index. Implications of this analysis for EPA's analysis of LT-LCR are multiple:

1. The proposed change would require thousands of small water systems, many of which are located in rural areas, to re-evaluate corrosion control to control the corrosivity of their water to copper.
    a. A significant number of small systems with corrosion control in place would be directed to change corrosion control practice.
    b. A large number of small systems would be required to add corrosion control.
2. State programs would need to evaluate:
    a. Current decision-making processes to understand why current practice is leading to non-optimal corrosion control practice for copper as well as lead.
    b. A very large number of corrosion control studies, corrosion control treatment installations and permit revisions, with associated oversight of implementation schedules and compliance metrics.
    c. Oversight practices and staffing to an increased number of small water systems employing active treatment, particularly where addition of corrosion control becomes a threshold treatment that sets the stage for additional unit operations (e.g., manganese or iron removal, disinfection, etc.).
    d. Changes to operator certification for small systems to ensure adequate training to oversee more complex groundwater treatment.

AWWA supports the NDWAC recommendation to focus efforts to prevent release of copper into water where the water is corrosive to copper. However, when we consider the above two analyses in the context of observed copper levels from compliance monitoring, the data illustrate that the assumptions underpinning the NDWAC corrosivity criteria are very conservative and warrant refinement before such a framework is included in regulation.

COPPER – TRIGGERED ACTIONS

The marginal return in public health benefit must be sufficient to warrant new triggered requirements under the LCR. If a system's water is deemed to be corrosive, then required actions could take one or more forms, including public education, additional monitoring and corrosion control treatment. The NDWAC recommendations ask a threshold question: Is there a substantial opportunity for additional risk reduction by contemplating changes to the copper requirements? The NDWAC workgroup discussion also focused on aligning the final lead and copper monitoring and response framework in the rule so that it did not create conflicting objectives, undue burden or oversight challenges.

From a community water system perspective, both metals should be adequately managed. Moving forward, implementation challenges include:

1. Implementing and communicating to customers about a compliance monitoring dataset drawn from "fresh" copper (e.g., new homes), particularly in small rural communities where the number of "new" homes can be very limited.
2. Coordinating with local municipal building permit programs where a water system (public, investor owned/operated, non-incorporated rural subdivision) does not have an immediate governmental tie to that department.

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3. Absence of local government planning/building permit information systems that align street addresses with water system service area boundaries.
4. Effectively identifying new-home buyers/renters of newly constructed homes that have copper plumbing and reaching them in a timely fashion with information on the importance of allowing copper to passivate and how to improve water quality in new homes.

PUBLIC EDUCATION ON COPPER

Providing informational material to new customers, plumbers, and developers on the release of copper prior to passivation is an educational opportunity for EPA and water systems. There are opportunities to provide general communication materials on copper passivation. NDWAC recommended a strong reliance on public education as the next step in improving copper risk reduction. Given the nature of the sensitive subpopulation for copper, the need to include a public education requirement on copper in drinking water in the LCR revisions will depend on the initial evaluation of the threshold question as to the risk reduction opportunity afforded by increased focus on copper in the LCR.

MODIFY TAP SAMPLING TO REQUIRE SEPARATE SAMPLING SITES FOR COPPER

The appeal of a workable copper corrosivity index is that it reduces the challenge of developing a separate tap sampling protocol for copper. Answering the question of whether a dedicated sample pool is necessary for copper is highly dependent on the balance of the rule option being considered. If the rule option requires weighting the sample pool heavily toward structures with lead service lines, then unpassivated copper is less likely to be present than in other alternatives. Again, the threshold question is whether there is a need for a more sensitive copper monitoring sample in most systems given the opportunity for health risk reduction:

1. Not all systems have significant numbers of lead service lines,
2. There is the opportunity to enhance risk reduction through public education targeting structures with fresh copper piping, and
3. The amount of installed copper pipe has decreased substantially since LCR was first promulgated (see Figure 6, tons of tube sold to all uses as a surrogate for use in plumbing alone).

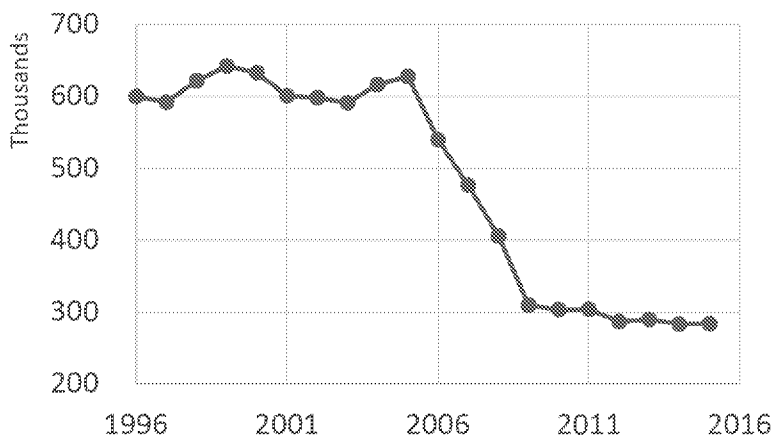

Figure 6: Tons of copper tube consumption in end-use markets[84]

[84] Copper Development Association, Annual Data 2017, Copper Supply & Consumption — 1996–2016. 2017, Available 2/16/2018 at www.copper.org/resources/market_data/pdfs/annual_data.pdf.

Appendix A. Observations on EPA Modelling to Calculate a Household Action Level

The following are observations regarding EPA's development of a household action level, prepared by Dr. Douglas Crawford-Brown.

RELIANCE ON LCR COMPLIANCE MONITORING DATA

I assume here that some variant of Figures 4A and 4B from the EPA's Environmental Health Perspectives paper would form the basis of any proposed health-based benchmark. If Figure B is used – since it involves aggregate exposure assessment and not only exposure via water – The water concentration corresponding an aggregate BLL value of 5 ug/dL in the 97.5th percentile is approximately 4 ugPb/Lwater.

However, this figure relies on use of the Six-Year review data on Pb in water. This is not a representative sample of the US population, but rather a sample of first draw results in a subpopulation identified by water providers as being most at risk from waterborne Pb. The three approaches being considered by the EPA in establishing a health-based benchmark, however, all rely on the national exposures.

Data presented by the EPA in the supporting documents for the EHP paper suggest a ratio of first draw concentration over daily average water concentration of between 2 and 4. It is unknown how biased (high) the sampled population of homes is within the overall distribution of homes. At the least, therefore, the 4 ugPb/Lwater value mentioned above should be raised to between 8 and 16 ugPb/Lwater based solely on the issue of using a database of first draw samples. This range encompasses the value of 15 ugPb/Lwater currently forming the basis of risk mitigation decisions under the LCR.

RELIABILITY OF ESTIMATE AT EXTREMES OF EXPOSURE DISTRIBUTION

Additionally, Figures 4Aand 4B reflect exposures at the 97.5th percentile. While it would be highly protective to use such a high percentile value, Figure 2 demonstrates that the curve of percentile versus BLL is characterized by a very high slope above the 90th percentile, being almost vertical. Very small errors in the curve, introduced by small errors in the uptake rates for the different pathways, would result in very large shifts in the water concentration associated with a given BLL (3.5 or 5 ug/dL) at this percentile. Use of the 95th percentile would increase the benchmark concentration further above the range of 8 to 16 ugPb/Lwater mentioned above (see Table 1 of the EHP paper, comparing the 95th and 97.5th percentile values).

This issue, coupled with that in item 1 above, suggests that the current value of 15 ugPb/Lwater as an 'action level' of some kind is already protective of the 'representative child' mentioned directly in Approaches 1 and 2 of the Modeling Review Panel charges.

REPRESENTATIVE CHILD OR ANOTHER TARGET SUBGROUP

Continuing with the issue of the nature of the Six-Year review water data, it is not defined anywhere in the EPA risk assessment (including the EHP paper mentioned above) what specific subpopulation is represented by those data in regard to waterborne exposures. Again, the values in the database are clearly dominated by first draw samples (known to be higher on average than a true nationally representative sample) in homes suspected of being at greater-than-average risk of waterborne Pb exposures. This is not consistent with the idea of using a 'representative child' in Approaches 1 and 2, and does not produce an accurate probabilistic analysis under the methods in the EHP paper.

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While the AWWA has been able to fully reproduce the results of the EHP paper, including the Monte Carlo (probabilistic) analysis, the EHP paper does not describe the nature of the subpopulation exposed to water at these levels, or the percentile of the US population of children represented in the probabilistic results in the paper. Instead, the EHP paper provides the 95th and 97.5th (and other) percentiles for the SAMPLED population under the Six-Year review data, which is not the same as a nationally representative sample. In establishing a health benchmark based on any of the three proposed Approaches, the EPA should consider how it will enhance the database of water exposures to reflect the nationally-representative population characteristics mentioned in the three Approaches.

TRANSLATING BLOOD LEAD LEVEL TO IQ DECREMENT

The underlying health concern for Pb exposure of children is the impact on IQ during development. The epidemiological studies cited by the EPA use BLL value and IQ as the regression variables. However, the IQ measure is in children at the upper end of ages considered in the current analyses (including the EHP paper), as is the exposure (or dose) measure of BLL.

From these epidemiological studies, one can discern the value of the BLL that corresponds to a given increment of IQ, relative to very low BLL values. That is scientifically sound methodology. However, the EHP paper (and related documents) calculate the BLL at other, younger, ages, such as 0 to 6 months and 1 to 2 years.

Based on usual regulatory practice, there will be a tendency to use the value of the BLL associated with a given IQ decrement (as determined from the higher childhood ages noted above), and apply this limiting value to the two younger age groups, keeping all age groups below the assigned BLL. This would not be correct because the impact of BLL on IQ is cumulative over the period from birth (in fact, from fetus) to the age at which the BLL-IQ relationship was measured. This relationship already includes the impact of exposures at the younger ages. It is more scientifically correct, therefore, to assess the BLL throughout the period from birth (or fetus) to the age of measurement of IQ in the epidemiological studies.

COMPARING BENCHMARK APPROACHES

Continuing with the issue of the non-representative nature of the current water concentration database used in EPA analyses, consider the three health benchmark Approaches under consideration at the EPA:

The level of lead in drinking water that results in an individual infant or child's probability of an Elevated Blood Lead Level (EBLL) being increased by 1 or 5 percent.

The level of lead in drinking water that results in an individual infant or child's BLL increasing by 0.5 or 1 μg/dL.

The level of lead in drinking water that results in the 95th or 97.5th percentile of predicted BLLs in the U.S. population of infants or children being equal to 3.5 or 5 μg/dL.

Note that Approach 3, which is the Approach used in the EPA's EHP paper mentioned above, requires the representative national distribution (which is not currently available). However, Approaches 1 and 2 do not, as they seek a maximum water Pb concentration consistent with the stated aim. In addition, Approach 1 formulates the benchmark in terms of a percentage increase in BLL, which has little scientific basis and would be difficult to justify publicly as it is not related to any specific health outcome. Approach 2 is therefore the only one of the three that is both scientifically defensible (being related to a numerical decrease in IQ amongst a nationally representative population) and avoids the need for a representative water concentration distribution.

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Approach 2 also comes closest to the recommendation of the NDWAC if one considers a 'representative' or 'average' child's increase in BLL. Using the regression equations underlying Figure 4A of the EHP paper, the water concentration that produces an increment of 1 ug/dL at the 97.5th percentile is 7.4 ugPb/Lwater (3.7 ugPb/Lwater for 0.5 ug/dL). However, these two values are for an individual at the 97.5th percentile, and therefore not 'representative'. Table 1 of the EHP paper displays the BLL values calculated for the 50th (representative) and 97.5th percentiles in the case of aggregate exposure. The ratio of these two values (97.5th/50th) is approximately 4.6/1.3 or 3.5. The water concentration corresponding to a 1 ug/dL increment in the 50th (representative) percentile is therefore 26 ugPb/Lwater (13 ugPb/Lwater for 0.5 ug/dL increment). If one considers only variability due to water uptake, these values are approximately 20 ugPb/Lwater (10 ugPb/Lwater for 0.5 ug/dL increment).

USE OF RESULTING VALUE

Bear in mind also that all of the above potential target values refer to a volume-weighted average of water concentration in exposed individuals, and not a 'first-draw' sample. This is consistent with the nature of the exposure index in the epidemiological studies. The target value (or health benchmark, or whatever term is used in the end) of water concentration therefore should be compared against this volume-weighted average rather than a 'first-draw' value.

Prepared by Dr. Douglas Crawford-Brown

Dr. Douglas Crawford-Brown is Professor Emeritus of Environmental Science and Policy at the University of North Carolina - Chapel Hill, where he was founding Director of the UNC Institute for the Environment. He moved to the UK in 2007, becoming Director of the University of Cambridge Centre for Climate Change Mitigation Research. He retired in 2016 to focus on delivery of sustainability solutions globally, relocating to California. He has more than 35 years of experience in all aspects of environmental, energy, climate change and sustainability work. This includes advanced research, education, policy advising and stakeholder engagement, with past projects involving partners in business, industry, government, academia and NGOs. He has served on a wide array of state, national and international committees and has provided advice and training in the US, UK, EU, France, Abu Dhabi, Dubai, Japan, India, Mexico, Austria, Taiwan, Thailand and China. These public service activities include membership on the USEPA's National Pollution Prevention and Toxics Advisory Committee, National Drinking Water Advisory Committee, Clean Air Scientific Advisory Committee, and Endocrine Screening and Testing Advisory Committee; on the American Water Works Association Technical Advisory Workgroup; on the ILSI Expert Panel on Modeling Pesticide Concentrations in Water Supplies and the ILSI Committee on Aggregate Risk Assessment Issues in Surface and Groundwater Pesticide Contamination; on the UK's HM Treasury Engineering Interdependency Expert Group, the Climate Change Commission Climate Change Risk Assessment team and OFWAT's Regulatory Futures Panel; and on the International Commission on Radiological Protection Task Group on Age Dependent Metabolism and Dosimetry.

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Message

From: Steve Via [SVia@awwa.org]
Sent: 6/25/2020 3:45:21 PM
To: Burneson, Eric [Burneson.Eric@epa.gov]
Subject: FYI
Attachments: Belzer 2020 APP (Achieving Economically Feasible Drinking Water Regulation).pdf; Belzer 2020 (Achieving Economically Feasible Drinking Water Regulation).pdf

Eric,

I imagine you have seen earlier drafts of the attached. I am still wondering who funded this particular piece of work. It felt like he shopped it around a lot.

I am not a particular fan of the analysis but now that it is published, I imagine we'll see it pop up on various email distributions, social media, perhaps in the trades.

Best regards,
Steve

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Richard B. Belzer

Achieving Economically Feasible Drinking Water Regulation

Abstract: United States Environmental Protection Agency (USEPA) has regulated drinking water since the 1974 Safe Drinking Water Act (SDWA). Congress directed it to achieve three conflicting goals: (i) establish stringent nationwide standards, (ii) ensure that these standards are both technologically and economically feasible, and (iii) accommodate significant differences in cost among water systems of different sizes with different water sources. USEPA chose to emphasize goal (i) at the expense of (ii) and (iii). In 1986, Congress intensified its preference for (i), was silent concerning goal (ii), and criticized USEPA for failing to achieve goal (iii). In lieu of economic feasibility, the Agency substituted "affordability," defined as expenditures up to 2.5 % of national median household income irrespective of the benefits. This imposed dead-weight losses, and substantial inequities on rural areas, low-income communities, and low-income households generally. In 1996, Congress directed USEPA to use benefit-cost analysis positively and normatively. Regulations issued since 1996 do not appear to comply, however. A review of post-1996 drinking water standards indicates that most were certified by USEPA as having benefits that justified costs, but these determinations were unsupported by the Agency's own regulatory impact analyses. This article proposes that USEPA define by regulation that "economic feasibility" means marginal benefits exceed marginal costs for the smallest water system subject to SDWA, and that all future drinking water standards must be economically feasible. Economic efficiency would be greatly enhanced and the pervasive inequities of "affordability" greatly diminished. Unlike "affordability," this definition is objective and compatible with lay intuition about the meaning of key regulatory terms.

Keywords: economic feasibility; SDWA; drinking water regulation; affordability; equal protection.

JEL Classifications: D78; H42; H77; L51; Q53; Q58.

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1 Introduction

Drinking water has been comprehensively regulated in the USA since the passage of the Federal Safe Drinking Water Act of 1974 (SDWA, 1974). Like other federal environmental statutes, SDWA 1974 assigned a dominant regulatory role to the U.S. Environmental Protection Agency (USEPA) in promulgating National Primary Drinking Water Regulations (NPDWRs), usually by setting uniform maximum contaminant levels (MCLs), and required the States to develop programs to implement federal standards. States that developed such programs could become *primacy* states authorized to enforce federal law; states that did not were subject to direct regulation by USEPA. Most drinking water was (and remains) supplied by intrastate utilities relying on intrastate sources, so the logic for Federal preemption is not clear-cut. State drinking water statutes mimic the federal SDWA, in some cases establishing a greater role for economic feasibility. For example, California drinking water standards are explicitly required to be both technologically and economically feasible (California HSC § 116365(b)).

SDWA 1974 sought to achieve three goals: (i) establishing national standards binding on all states and localities that are as close to zero risk as technologically possible, (ii) ensuring that these standards are both technologically and economically feasible, and (iii) accommodating significant differences in cost among water systems of different sizes relying on different sources. These three goals were in tension if not conflict from the start. Stringent national standards could provide robust public health protection only by sacrificing economic feasibility. Standards that were economically feasible for very large metropolitan water systems would not be economically feasible for the vast majority of public water systems, which were (and still are) small. Accommodating small systems' diseconomies of scale requires sacrificing stringency.

USEPA implemented SDWA 1974 by emphasizing stringency over economic feasibility and the accommodation of small systems (Schnare, 1998). Congress amended SDWA in 1986 (SDWA, 1986) reiterating Congress's preference for regulatory stringency. However, Congress changed direction in SDWA 1996, formally directing USEPA to apply benefit-cost principles positively and normatively. This included identifying and analyzing multiple regulatory alternatives, taking account of incremental effects, and estimating risks and benefits "in accordance with sound and objective scientific practices" (§ 1412(b)(3)). Also for the first time, Congress explicitly authorized USEPA to refrain from promulgating standards whose benefits did not justify their costs (§ 1412(b)(6)(A)).

However, SDWA does not define *economically feasible* or any of its analogues. In this paper, economic feasibility is defined as the condition in which benefits exceed costs, where both are typically calculated at the margin (i.e., marginal net benefits are positive). This definition is objective and grounded in economic

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principles. It also is intuitively appealing to non-economists, who may struggle to understand how a consumption decision ever could be economically "feasible" if it made them worse off – a necessary outcome if costs exceed benefits. Any scenario in which benefits are ignored cannot be economically feasible. Thus, *economic feasibility* explicitly excludes *affordability*.

2 Affordability

Since 1974, USEPA managers preferred to ensure that NPDWRs are *affordable* rather than economically feasible (Schnare, 1998). Unlike *economic feasibility*, the term *affordability* has no objective meaning; it is not grounded in economic principles; and its intuitive appeal among non-economists depends on its interpretation.[1] In SDWA 1996, Congress ratified *affordability* as a desirable policy goal but did not define it. Moreover, though presumably aware of USEPA's similar pre-1996 definition of affordability in the context of water quality (not drinking water) (USEPA, 1995), Congress also did not necessarily endorse it. Rather, Congress directed the Agency to "publish information to assist the States in developing affordability criteria" (SDWA, 1996, § 1415(e)(7)(B)). Congress also did not authorize USEPA to promulgate federal affordability standards. Subsequently, *affordability* has become a blend of policy, guidance, and implicit regulation that is appropriately characterized as an Agency *doctrine* – "a codification of beliefs or a body of teachings or instructions, taught principles, or positions, as the essence of teachings in a given branch of knowledge or in a belief system" (Wikipedia, 2018).

The guidance describing USEPA's post-SDWA 1996 affordability doctrine (USEPA, 1998a, b) is simple in some respects but complex in others. Its simplest features are a reliance on median household income (MHI); the choice of MHI domain (national); and the establishment of 2.5 % of national MHI as the upper-bound threshold for household expenditures on drinking water deemed to be *affordable*. Multiple dimensions of variability, including regions, systems within a size category, and households served by individual systems, are not taken into account. As USEPA stated in 2006:

> Treatment technology costs are presumed affordable to the typical household if they do not cause median water bills to exceed an affordability threshold of 2.5 percent of MHI. This approach assumes that affordability to the median household in a system size category can serve as an adequate measure for the affordability of technologies to the size category as a whole (USEPA, 2006d, p. 10673).

1 A policy is both affordable and economically feasible if and only if benefits exceed costs.

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Note that the affordability doctrine is strictly cost-based; it does not account for the benefits realized by drinking water regulation. Further, the doctrine provides only limited relief from economically infeasible NDPWRs, under limited circumstances, to a limited array of public water systems, for a limited period of time.

2.1 The affordability doctrine meets arsenic

The affordability doctrine was tested in 2001 when the Agency promulgated a revised NPDWR for arsenic (USEPA, 2001c). The Agency determined that aggregate estimated annualized benefits of $170 million justified aggregate estimated annualized costs of $210 million, with unquantified benefits making up the difference. USEPA's benefit estimates were contested; for example, Burnett and Hahn (2001a, b) re-estimated them to be only $20 million.

The Agency's cost estimate also was controversial (USEPA, 2001b, pp. 7038–7041). For a 10 μg/L MCL, Frey et al. (1998, table 5) estimated annualized national compliance costs at $708 million, later revised downward to $495 million (Frey et al., 2000, table 4.8). Gurian et al. (2001) estimated annualized national compliance cost at $294 million, with 90th per cent confidence intervals ($177–$495 million) spanning the USEPA and Frey et al. (2000) estimates. Estimates of the national annualized incremental compliance cost for 10 μg/L instead of 20 μg/L include USEPA's figure of $129 million (USEPA, 2001b, table III.E-1), $174 million by Gurian et al. (2001, table 4), $360 million by Frey et al. (2000, table 4.8), and $550 million by Frost et al. (2002, table 1). This disagreement did not subside after promulgation of the final rule (Tiemann, 2006; Hilkert Colby et al., 2010; Gingerich et al., 2017).

Congress reacted swiftly to stakeholder concerns about economic feasibility, noting that the revised standard would impose "significant financial costs on many small communities, and many of these communities may find it impossible, because of the financial burden, to be in compliance by 2006 as the rule requires." Members on the appropriations conference committee were "concerned that, because of their complexity, the current waiver and exemption provisions … may not provide sufficient flexibility for the small communities to receive additional time to reach compliance." They also were "very concerned that … very small communities may abandon their municipal systems in favor of untreated and unregulated private wells which could create significant other health risks for these communities." They directed USEPA to, by March 1, 2002, "review the Agency's affordability criteria and how small system variance and exemption programs should be implemented for arsenic," taking account of the "undue economic hardship" faced by communities served by small public water systems." But the conferees also hedged their bets, averring that they "do not intend to create loopholes in the Safe Drinking Water Act for compliance to a national arsenic standard" (U.S. House of Representatives, 2001, pp. 174–175).

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2.2 USEPA's proposed revision to the affordability doctrine

In its report to Congress (USEPA, 2002a), USEPA defended the affordability doctrine but did not include the review Congress had directed be conducted. Instead, the Agency briefly summarized public comments received on the 2000 proposed arsenic rule and promised an "ongoing affordability review" that would include soliciting advice from the Science Advisory Board and obtaining "input from stakeholders" (p. 11). Two USEPA advisory committees weighed in with conflicting recommendations (U.S. EPA Science Advisory Board, 2002; U.S. EPA National Drinking Water Advisory Council 2003 [including a minority report]).

In 2006, USEPA proposed a revision to the affordability doctrine (USEPA, 2006d). The proposed changes would have had mixed or ambiguous effects, most notably the relaxation of the 2.5 % MHI regulatory budget. Doctrinally, the proposal reiterated the Agency's longstanding view that economic feasibility is limited to "what may reasonably be afforded by large metropolitan or regional public water systems" (p. 10682), thus leaving unaddressed the economic inefficiency and inequity discussed in Section 3. The proposed revision was widely criticized by public commenters (USEPA, 2006c) and subsequently by others (Rubin et al., 2007; Crawford-Brown et al., 2009; Raucher et al., 2011; U.S. Conference of Mayors et al., 2013a; U.S. Conference of Mayors, 2014). No revised guidance has been finalized.

2.3 Affordability v. economic feasibility in practice

USEPA has promulgated a number of drinking water rules since SDWA 1996, but in no case has the Agency clearly defined economic feasibility.[2] Some inferences can be made from the Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR), in which the Agency stated that "it may not be economically feasible for some small systems to install and operate an on-site [granular activated carbon] reactivation facility" (USEPA, 2006a, p. 413). USEPA estimated the 50th, 90th, and 95th percentile costs for small systems at $18, $169, and $198 per household served (USEPA, 2006a, p. 459, table VI.E-1). Thus, it might be inferred

2 Two final rules mention the similar term *economically feasible*, but in neither case is the term explicitly defined. See USEPA (1998c, p. 69400 [a restatement of statutory language] and p. 69412 [a declarative statement that a particular standard is "technically and economically feasible"]); and USEPA (2006a, p. 413 [stating that a particular technology "may not be economically feasible for some small systems to install and operate"]).

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that USEPA believes the latter two average household-level costs are *not* economically feasible. However, because the Agency did not report benefit estimates by system size, apparent statements about economic feasibility actually may be about affordability.

Inferences also cannot be readily derived from pre-SDWA 1996 rulemakings. For example, in 1994 USEPA re-proposed a NPDWR for sulfates and said that four options "would be economically feasible" despite the financial difficulties presented to small systems (USEPA, 1994, p. 65597). With respect to an option costing on average $287 to $811 per household, depending on system size, the Agency acknowledged "concerns that this option would not be economically feasible for small systems" (table 9). As before, because benefits are absent from the discussion, these statements may be about affordability, not economic feasibility. Further, any inference about USEPA's intentions must be tempered by the knowledge that the reproposed standard was not promulgated.

Nothing can be inferred from USEPA statements about feasibility without a modifier. The Agency interprets any unmodified use "in terms of technological limits of concentration removal (i.e., treatment) and analytical methods (i.e., sampling and measurement)" (Raucher & Cromwell, 2004, p. 2) – i.e., without economic content. In short, it appears that a general principle of *economic* feasibility is ground that USEPA has never plowed in the context of drinking water because it was supplanted by the affordability doctrine.

But the affordability doctrine appears to have reached its practical limit, as the cost of drinking water now approaches (and may even exceed) the 2.5 % MHI regulatory budget. Raucher and Cromwell (2004) relied on USEPA RIAs to build their best estimates of aggregate compliance costs of SDWA 1996 regulations ($1.8 billion per year) and seven regulations promulgated under SDWA 1986 ($4.8 billion per year) (both at 2004 $; 7 %). Household-level equivalents are generally not available because they are absent from the RIAs. Nonetheless, household-level estimates may breach the affordability threshold. In the case of the Arsenic NPDWR, for example, Raucher and Cromwell conclude that "average households in the smallest system size category will pay at least 14 times as much (on average) as households served by utilities in the largest size categories," with annual compliance cost per household exceeding $700 (pp. 20–21).

Other analyses have obtained similar results. In a recent California study, the median (SD) total cost of drinking water for surveyed communities was estimated at $1,172 ($488) per household, with costs in many jurisdictions exceeding the 2.5 % MHI regulatory budget (U.S. Conference of Mayors, 2014, pp. 4, 12, 13, table C). At some point, it may not be possible for USEPA to promulgate new NDPWSs without unambiguously violating its affordability doctrine.

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3 Inefficiency, Inequity, and Arbitrariness in Federal Drinking Water Regulation

It is therefore not surprising that many NPDWRs are economically inefficient. From the outset, SDWA directed USEPA to set stringent national standards while providing ways for small systems to escape the higher cost of complying with standards that were not economically feasible. But the Agency emphasized regulatory stringency and provided limited accommodation to small systems (Schnare, 1998). This led Congress to require benefit-cost balancing in SDWA 1996.

SDWA regulations also are inequitable. They impose significantly disproportionate costs on nonmetropolitan areas, low-income communities, and low-income households generally. The tradeoff between efficiency and equity, made famous by Okun (1975), does not seem to apply.

3.1 Inefficiency

NPDWRs are economically inefficient at least four ways. First, as noted earlier, USEPA sets standards based on what it determines to be economically feasible for very large public water systems (USEPA, 2006d, p. 10682). Because economies of scale in drinking water supply and treatment are so strong, standards that are economically feasible for very large systems are virtually certain to be economically infeasible for small systems.

Second, neither variability across systems within a system-size category nor household variability within each system is considered (USEPA, 2006d, p. 10673). Thus, even if a NPDWR were economically feasible for the median system in a system-size category, it would be economically infeasible for as many as half of the systems in that category, and as many as half of the households in the median system.

Third, USEPA estimates compliance expenditures, not opportunity costs. At the household level, this means not counting the benefits foregone from reduced expenditures on food, shelter, education, health care, transportation, and expenditures on goods and services that improve health (Keeney, 1990, 1994; Lutter & Morrall III, 1994; Lutter et al., 1999; Cory & Taylor, 2017). At the system level, expenditures to comply with economically infeasible NPDWRs reduce resources available for infrastructure investments, the need for which has been estimated to exceed $1 trillion over 25 years (AWWA, 2012). This includes extensive replacement of drinking water service lines to reduce or eliminate lead exposure, ironically to comply with a different and notoriously expensive NPDWR. When net social benefits are

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estimated, they are upwardly biased because expenditures, not opportunity costs, are subtracted from estimated benefits.

Fourth, the affordability doctrine does not take account of benefits, and even if benefits were counted, USEPA's estimates tend to be upwardly biased by the Agency's longstanding practice of "policy framing" risk estimates at the "upper end" (U.S. EPA Office of the Science Advisor, 2004). Thus, even if opportunity costs were properly estimated and subtracted from benefits, estimates of net social benefits would be upwardly biased.

Evidence of economic inefficiency extends back to early SDWA 1974 regulations, when several economic inefficiencies were identified (Council on Wage and Price Stability, 1978) in USEPA's 1978 proposed trihalomethane NPDWR (USEPA, 1977). The standard was estimated to cost on average $3.9–6.3 million ($1978) per excess cancer case prevented, depending on stringency, but exceed $12 million per case for water systems serving 75,000 or fewer persons. These inferences were confirmed and extended to other NPDWRs in subsequent analyses (Morrall III, 1986; Office of Management and Budget, 1991; Raucher et al., 1994).

3.2 Inequity

Households served by small systems are assured of being treated inequitably multiple ways. First, the affordability doctrine imposes disproportionate burdens on lower-income households (U.S. EPA Science Advisory Board, 2002, Berahzer, 2012; Teodoro, 2018). Households with income below the MHI must pay more than 2.5 % of their income for drinking water.

Second, USEPA ignores regional and State differences in MHI. Median households in regions and States with lower MHIs therefore must pay more than 2.5 % of their income for drinking water. National MHI in 2016 was $58,820 (90 % CIs: ± $102), but ranged from $40,528 (90 % CIs: ± $258) in Mississippi to $72,935 (90 % CIs: ± $1,164) in the District of Columbia – a range of 1.8x. About 60 % of Mississippi households earned $50,000 or less compared to 38 % of District households (U.S. Census Bureau, 2016).

Third, communities with below-average incomes must bear costs that the Agency regards as unaffordable by households served by large metropolitan systems. MHI in all 82 Mississippi counties was below the national MHI in 2016. In 20 % of Mississippi counties, MHI was less than half of the national MHI (U.S. Census Bureau, 2016). The affordability doctrine requires that they commit 5 % of income, or more, to drinking water. This is equivalent to a peculiar regressive tax that, instead of producing government revenue, transfers wealth from the poor to firms in the water treatment industry.

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3.3 Arbitrariness

The affordability doctrine relies on other arbitrary elements besides the 2.5 % national MHI threshold, and thus results in outcomes that are inherently arbitrary on other margins as well (U.S. EPA Science Advisory Board, 2002; Irvin, 2017). Each of the 151,000 water systems in the USA (USEPA, 2017) could be defined as its own domain or aggregated into a single domain for standard-setting. In practice, water systems are aggregated into arbitrarily defined system-size categories in the expectation that variability is captured by economies of scale. But as Gingerich et al. (2017) showed for small systems participating in an Agency-sponsored demonstration project exploring arsenic treatment alternatives, direct costs can be highly variable for reasons other than system size. The median annual treatment cost among systems in this demonstration project was $147 per household, but ranged from $17 to $662 per household. The median increase in total water bill was 55 %, but ranged from 6 to 274 %.[3] These ranges suggest that the arsenic MCL may not be technologically feasible for small systems "under field conditions," as required by SDWA 1996 § 1412(b)(4)(D).

Similarly, there is nothing special about MHI as an affordability metric, nor does the particular MHI statistic obtained from the Census Bureau lack critics (see, e.g., Eskaf, 2013; Irvin, 2017). Several alternative approaches have been suggested to make the affordability doctrine sensitive to the disproportionately high opportunity costs experienced by low-income households (Raucher et al., 2011; U.S. Conference of Mayors et al., 2013a, b; UNC Environmental Finance Center, 2017; Teodoro, 2018, 2019; Czerwinski et al., 2018; Raucher et al., 2019). USEPA did not propose to adopt any of the earlier recommendations but may be considering the more recent ones.

3.4 USEPA's policy of ensuring equal *ex post* health risk from drinking water imposes highly unequal *ex post* risk elsewhere

Equal protection can be defined as ensuring that people receive the same quantity at different prices or pay the same price and receive different quantities. Quantity-based equal protection is reasonable and appropriate for the provision of constitutional rights (e.g., free speech, protection from unreasonable search and seizure, trial by jury) and public goods supplied by government and funded by general taxation

3 Figures derived from Gingerich et al. (2017, table 3).

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(e.g., national security). However, drinking water is a private good even where it is provided by a public entity. Consumption is rivalrous, and sellers can deny access to those who refuse to pay.

Drinking water is more like other private goods and services, such as electricity, natural gas and sewage treatment that often are supplied by regulated public or private monopolies because of high fixed costs. Where risk reduction is an attribute of a private good or service, consumers typically pay the same price but obtain different quantities of risk reduction depending on other factors, such as their propensity for risk-taking. The result is variability in *ex post* risk outcomes, not *ex post* price differences. Indeed, in some jurisdictions, public utilities are statutorily required to charge all customers the same rate (Berahzer, 2012; U.S. EPA Environmental Financial Advisory Board, 2016; UNC Environmental Finance Center, 2017), a practice that is consistent with *price*-based equal protection.

A few examples from outside the world of public utilities provide additional insight. For decades, automobile manufacturers marketed as options various safety features, such as seat belts, air bags, and antilock brakes, charging the same price to all similarly situated customers. But customers varied greatly in the amount of risk reduction they obtained, largely due to fixed differences in baseline risk and their propensity to engage in risky behavior. The same pattern applies to newly invented automotive safety features, such as lane-departure, forward-collision, and blind-spot warning technologies. The unit price of these technologies is fixed, at least in broad categories, but the quantity of risk reduction obtained varies across consumers. Persons who are relatively risk-averse, or have reason to believe that they are riskier than average, are more likely to purchase these safety innovations. Some consumers also are more likely to adapt their behavior in ways that reduce risk-reduction benefits (Peltzman, 1975). Regardless of their baseline risk, preference for risk-taking, or propensity to engage in adaptive responses that reduce benefits, they still pay the same price.

There is a vibrant consumer market for inherently risky power tools. Operating risk varies greatly because consumers differ in baseline conditions (e.g., experience, technical skill, intensity of use) and their propensity to engage in risky behavior (e.g., read and follow directions, wear protective clothing and equipment). Still, all consumers pay the same price for each risk-reduction technology built into these products. What varies across consumers is the quantity of risk reduction obtained.

This pattern applies even to speculative benefits. The establishment of the National Organic Program by the Agricultural Marketing Service of the U.S. Department of Agriculture gave food producers a government-sanctioned way to appeal to consumers who believe that foods certified as organic are safer than conventional foods. Consumers who purchase certified organic foods pay the same, higher unit prices regardless of how much psychological benefit they receive.

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It is difficult to find examples of private goods with risk-reducing attributes that deliver the same *ex post* risk but, like drinking water under EPA's quantity-based equal protection policy, cost consumers widely different amounts. The typical consumer experience is one of variable *ex post* risk resulting from differences in baseline risk, risk preferences, and the net quantity of risk reduced – not differences in the price of the risk-reducing attribute or feature.

Since 1974, USEPA has implemented SDWA to ensure the same level of *ex post* protection from drinking water contaminants (Schnare, 1998), not the same price for risk reduction. The practice appears to have been first codified as policy during the National Performance Review (NPR), a management effort to streamline federal government operations to improve performance and reduce costs (Gore Jr. 1993, 1994). Although official NPR reports are silent on equal protection, USEPA appears to have leveraged the NPR to make quantity-based equal protection as Agency policy (USEPA, 1996).[4]

By insisting on quantity-based equal protection for potential health risks, USEPA imposes highly unequal protection from actual financial risks that inevitably result from highly unequal prices (Raucher, 2003).[5] Households served by small systems cannot obtain the same quantity of *ex post* health risk except by bearing disproportionately large financial risks. Similarly troubling is the highly unequal protection from financial risk imposed on nonmetropolitan areas, low-income communities, and low-income households generally, that inevitably results from compulsory quantity-based equal protection from potential health risks. Environmental justice advocates have challenged differential health protection in drinking water as a violation of Title VI of the Civil Rights Act, but these efforts have not succeeded for lack of discriminatory intent (Lado, 2017). But the case for intentional discrimination is stronger with respect to regulatory policies that, like USEPA's practice in SDWA, knowingly impose disproportionate financial risks on the poor.

4 See p. 2: "The basic concept of environmental protection has evolved beyond just pollution control to include broader issues, such as pollution prevention, sustainability, and environmental justice – e.g., businesses are looking to cut waste in order to prevent pollution and improve profitability; government agencies are developing incentives that can lead businesses and communities to go beyond compliance and continuously improve environmental performance; *citizens demand government policies that ensure equal protection against environmental risks* and create economic opportunity for present and future generations" (emphasis added).

5 See p. 232: "While a uniform MCL for small and large systems does provide households with roughly 'equal health protection' in terms of exposure, regardless of where they live or the size of the community water system (CWS) that serves them, the cost burden that each system bears can be significantly different. In essence, any given MCL is likely to impose much higher costs per unit of risk reduction benefit received by households served in small systems relative to the costs per risk reduction borne in larger communities. This raises a fundamental issue of fairness — should families served by small systems be forced through regulations to pay much higher costs for their risk reduction benefits than do households in larger, more urban settings?"

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4 A Rational Economic Interpretation of the SDWA Statutory Framework

SDWA as amended can be interpreted as providing the rational economic framework for standard-setting that was missing from SDWA 1974 and SDWA 1986. For any given contaminant or constituent, SDWA 1996 directs USEPA to promulgate NPDWRs that are "as close to the maximum contaminant level goal as is [technologically] feasible" (SDWA, 1996 § 1412(b)(4)(B)). But at the same time, the Agency must determine "whether the benefits of the maximum contaminant level justify, or do not justify, the costs" (SDWA, 1996 § 1412(b)(4)(C)) after an objective analysis of risks, benefits, and costs (SDWA, 1996 § 1412(b)(3)). USEPA could interpret these texts as requiring the promulgation of NPDWRs that minimize health risk subject to the twin constraints of technological and economic feasibility, and account for system size, source water, and other key factors in determining both technological and economic feasibility.

4.1 Pre-SDWA 1996: Deadweight Losses and Inequity through Selective Economic Feasibility

For all but the largest metropolitan water systems, NDPWRs have been economically infeasible by design (USEPA, 2006d, p. 10673). Variances and exemptions were theoretically available for small water systems (Schnare, 1998), but relief if granted was temporary, and systems were generally required to comply with standards that were less stringent than NPDWRs but still economically infeasible. That is, systems for which NPDWRs were economically infeasible had no option except to comply by making their customers poorer.

This is illustrated in Figure 1. Assume six alternative MCLs ranging from MCL_a (the most stringent) to MCL_f (the least stringent), and three different sizes of public water systems (large [L], small [S] and very small [VS]), which for simplicity in exposition are all presumed to have the same baseline level of a contaminant. Economies of scale in water treatment result in three different marginal cost schedules (MC_L, MC_S, and MC_{VS}) and the common marginal benefit schedule MB. All six alternative MCLs are technologically feasible for all three system sizes, so USEPA would have chosen MCL_b as the NPDWR. MCL_b is economically feasible for large systems because the marginal benefit of treatment equals the marginal cost ($MB = MC_L$). Households served by large systems would pay a price of P_L.

Though it is technologically feasible for small systems to achieve MCL_b, they can only do so at the higher household price P_S. Households served by small systems

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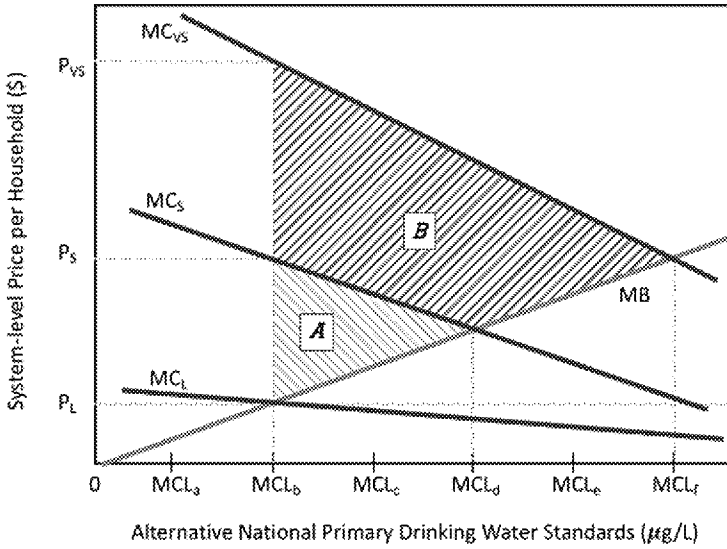

Figure 1. Traditional standard-setting under the Safe Drinking Water Act.

therefore are unambiguously worse off. At the margin, they pay P_S to obtain benefits worth only P_L. The difference in expenditure, $P_S - P_L$, multiplied by the quantity of drinking water consumed, is transferred from their family budgets to firms that design, manufacture, install, or operate water treatment technology. They suffer a deadweight loss equal to area A.

The situation is worse for households served by very small systems. They must pay P_{VS} for benefits worth only P_L. They must transfer even more income to firms in the water treatment industry. They suffer the deadweight loss of areas A plus B.

These inefficiencies have been defended on equity grounds by defining equity in terms of a quantity-based definition of equal protection. While it is true that all households gain the same *ex post* quantity of health risk, households served by small and very small public water systems obtain this only by being made permanently poorer. USEPA achieves quantity-based equal protection from health risk by reducing the welfare of those it purports to benefit.

4.2 Achieving efficiency and reducing inequity through economic feasibility

Interpreting SDWA 1996 as a problem of risk minimization subject to technological and economic constraints allows economic inefficiency and price-based unequal

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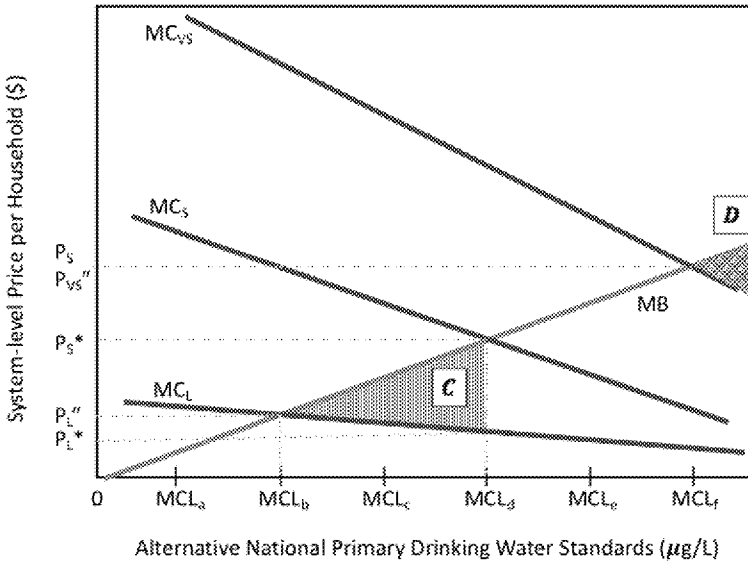

Figure 2. Economically feasible standard-setting under the Safe Drinking Water Act.

protection to be substantially reduced. This can be accomplished by setting NPDWRs that are both technologically *and* economically feasible for the smallest size systems subject to regulation. That is, USEPA would interpret SDWA 1996 §§ 1412(b)(4)(B)-(C) as applying consistently to all water systems subject to federal standards, not just the handful of metropolitan systems large enough to spread compliance costs over hundreds of thousands or even millions of households. The structure of the amended statute arguably is more consistent with this approach, which makes national standards a flexible floor instead of a *de facto* ceiling. States can choose to set more stringent standards, but they would have to transparently acknowledge, and take responsibility for, the resulting deadweight losses, reverse Robin Hood income transfers to the drinking water treatment industry, and the inequities of quantity-based equal protection.

Figure 2 shows how this would work. very small systems would be exempt. The MCL would be set at MCL_d, the most stringent standard that is economically feasible for small systems. Households served by large and small systems would pay prices P_L* and P_S*, respectively. The deadweight loss in Figure 1 would be avoided.

Initially, large and very small systems would suffer the deadweight losses in areas *C* and *D*, respectively, because in both cases there would be uncaptured net benefits from more stringent controls. But these deadweight losses likely would be temporary. Households served by large systems would be willing to purchase treatment technology sufficient to achieve MCL_b, the most stringent standard that is

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economically feasible for them. These households would pay P_L'' instead of the lower price P_L^*, but the marginal value of additional health benefits would exceed the price difference. Similarly, even though very small systems would be exempt, their customers would be willing to purchase treatment technology sufficient to achieve MCL_f, the most stringent standard that is economically feasible for them. Households served by very small systems would be willing to pay P_{VS}'' to gain the value of additional health benefits, which exceed marginal cost for every unit of contaminant greater than MCL_f.[6]

These choices are rational because both groups of households would be better off than under MCL_d. No regulatory coercion is needed to motivate large or very small systems to voluntarily achieve standards more stringent than MCL_d. Firms in the drinking water treatment industry would gain new incentives to invest in research and development that reduces the cost of serving the needs of very small systems instead of lobbying for federal standards that are profitable for them but financially damaging for very small system customers.

This solves the allocative efficiency problem because NPDWRs would not impose an economically infeasible drinking water treatment technology on anyone. Price-based unequal protection would remain, however, because households would pay prices inversely related to the size of the system serving them. But these price differences would reflect differences in cost of service, which generally are not perceived as a discriminatory practice in drinking water supply (UNC Environmental Finance Center, 2017, pp. 17–18).

The only other alternative that solves the allocative efficiency problem and achieves similarly equitable results requires EPA to set multiple MCLs within a single NPDWR.[7] This might be compatible with SDWA 1996, but it would have other significant drawbacks. First, it would require the Agency to obtain much more extensive knowledge across tens of thousands of water systems in the USA. This would be expensive and undoubtedly require a significant expansion in the ranks of its technical staff. Second, the task would be duplicative. The only logical sources for this information are local water systems. It is suboptimal to recycle local information through USEPA and return it as a regulation imposed on the same systems from which the data were obtained. A suboptimal federal information recycling loop might

6 In theory, a water system could respond strategically by breaking up into smaller units in order for each part to belong to a smaller system size category. If the purportedly smaller systems shared management control and, more importantly, treatment technology, States likely would recognize such responses as shams and deny them regulatory approval. On the other hand, both efficiency gains and inequity reductions might be realized in cases where water systems (typically those relying on groundwater) are inefficiently large as a result of prior efforts to comply with NPDWRs that disadvantage small systems. In these cases, subdivision might well be justified.

7 The option of setting dual standards is discussed in U.S. EPA National Drinking Water Advisory Council (2003), and U.S. EPA National Environmental Justice Advisory Council (2009).

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make sense if systems lacked sufficient expertise or faced perverse incentives to analyze their situations incorrectly. But systems have access to a wealth of technical expertise elsewhere (e.g., the American Water Works Association and the National Rural Water Association, among others), and the incentives they face are compatible with allocative efficiency, minimizing price-based unequal treatment, and responding to customer concerns.

5 Effects of Adopting the Economic Feasibility Principle

Predictions about the effects of the economic feasibility principle on future USEPA actions are inherently speculative. There is limited public information concerning which contaminants the Agency expects to advance to rulemaking. The Agency has disclosed, via the Fall 2018 Semiannual Regulatory Agenda, that it intends to propose revisions to the Lead and Copper NPDWR (RIN 2040-AF15) and a new NPDWR for perchlorate (RIN 2040-AF28) (Regulatory Information Service Center 2018). However, insufficient information has been publicly disclosed to allow even a preliminary determination of which alternatives, if any, may be both technologically and economically feasible.

The economic feasibility principle may receive its first test elsewhere. The California State Water Resources Control Board (SWRCB) is developing guidelines or regulations defining economic feasibility. This effort follows the remand and vacatur of a drinking water standard for hexavalent chromium (*CMTA et al. v. SWRCB*, 2017). The court interpreted the California SDWA, which is modeled on the federal SDWA, in a manner that is theoretically very similar to the economic feasibility principle proposed here, except that it left to the SWRCB the task of defining the term.[8]

Would the adoption of the economic feasibility principle after SDWA 1996 have resulted in reduced inefficiency and inequity? Some insight can be gleaned by reviewing post-SDWA 1996 regulations and attempting to discern whether USEPA would have chosen different regulatory alternatives. Retrospective inferences of this sort are necessarily limited to the economic analyses the Agency performed, and different alternatives likely would have been examined if economic feasibility had been an explicit regulatory objective. For this reason, any retrospective look at past regulations should be viewed as suggestive rather than dispositive.

8 "[T]he court interprets the [California] Safe Drinking Water Act as requiring the Department to set the MCL at a level that is *as close as economically feasible to*" the Public Health Goal. *CMTA et al. v. SWRCB*, 2017, p. 6 (emphasis added).

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Since 1974, USEPA has promulgated NPDWRs for 7 microorganisms, 3 disinfectants, 4 disinfection byproducts, 4 radionuclides, 16 inorganic chemicals, and 53 organic chemicals (USEPA, 2018b). This section summarizes the extent to which regulations promulgated since 1996 were economically feasible, and if not, whether an economically feasible alternative was considered. Further information is provided in the Online Appendix.

Table 1 lists the most relevant post-SDWA 1996 regulations, and reports whether (i) USEPA determined that benefits justified costs and (ii) the economic analysis identifies an option that would have been preferred under the economic feasibility principle. Only a few regulations meet both criteria; some do so, but inferences about alternative regulatory choices are still elusive. Details are summarized here; more information about the economic feasibility of these regulations is provided in the Online Appendix.

5.1 Surface water treatment regulations

A suite of surface water treatment rules targeting *Cryptosporidium* (USEPA, 1998d, 2001a, 2002b, 2006b) depended on benefit estimates obtained by risk modeling. These rules were determined to be economically feasible, but modeled illnesses and deaths averted substantially exceeded the number of illnesses and deaths reported from all pathways by the Centers for Disease Control and Prevention (CDC). Because the model was not validated and the substantial gap between modeled and reported illnesses and (especially) deaths was not adequately explained, it is reasonable to be skeptical about economic feasibility claims. It is possible that some or all of these rules were economically feasible for very large systems, where economies of scale yield low marginal costs. However, the gap between modeled and reported illnesses and (especially) deaths is so great that even this inference is doubtful. Moreover, it is highly unlikely that any of these rules were economically feasible for smaller systems.

5.2 Disinfection byproduct regulations

Two regulations were promulgated to manage risks from disinfection byproducts (DBP) (USEPA, 1998c, 2005). Any determination of economic feasibility depends on the assumption that mixed, weak, and unconfirmed epidemiological associations between DBP and cancer are causal. USEPA acknowledged that estimated cancer risks could be zero but assumed causality anyway. Without this assumption, neither regulation would have been economically feasible even for very large systems.

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Table 1. Post-SDWA 1996 rulemakings and economic feasibility.

Post-SDWA 1996 rulemaking	Date/reference	"Benefits justify costs"	Economic feasibility can be reasonably characterized based on USEPA analysis
Disinfectants and Disinfection Byproducts Rule (DBPR)	12/16/1998 63 FR 69390	Yes	No
Interim Enhanced Surface Water Treatment Rule (IESWTR)	12/16/1988 63 FR 69478	Yes	No
Lead and Copper NPDWR	1/12/2000 65 FR 2000	No	No
Revisions to IESWTR, Stage 1 DBPR	4/4/2000 65 FR 20304	No	No
Public Notification Rule	5/4/2000 65 FR 40520	No	No
Radionuclides NPDWR	12/7/2000	Yes	Yes
Uranium NPDWR	65 FR 76708	Yes	Yes
Revisions to IESWTR, Stage 1 DBPR	1/16/2001 66 FR 3770	No	No
Arsenic	1/22/2001 66 FR 6976	Yes	Yes
Filter Backwash Recycling Rule (FBRR)	6/8/2001 66 FR 31085	Yes[a]	No
Long Term 1 ESWTR	1/14/2002 67 FR 1811	Yes	No[b]
Stage 2 DBPR	1/4/2006 71 FR 388	Yes	Yes
Long Term 2 ESWTR	11/8/2006 71 FR 653	Yes	Yes
Ground Water Rule (GWR)	11/8/2006 71 FR 65573	Yes	Yes
Lead and Copper: Short-Term Regulatory Revisions and Clarifications	10/10/2007 72 FR 57782	No	No
Drinking Water Regulations for Aircraft Public Water Systems	10/19/2009 74 FR 53589	No	No
Revisions to the Total Coliform Rule (RTCR)	2/13/2013 78 FR 10270	Yes	No

[a] The Agency has determined that the benefits of the FBRR justify their cost on a qualitative basis.
[b] Key analytic documents are not publicly available.

5.3 Specific contaminant NPDWRs

For radionuclides, USEPA retained then-existing MCLs for combined Ra^{226} and Ra^{228} (though with intensified monitoring requirements), beta particle and photon emitters, and gross alpha activity. It declined to set a more stringent MCL.

For uranium, USEPA's estimates of aggregate net benefits were negative at every analyzed alternative. Thus, even the least stringent alternative analyzed (80 μg/L) was

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too stringent to be an economically feasible uniform NPDWR. According to USEPA's economic analysis, the 30 μg/L uranium MCL was estimated to yield about $50 million in negative net benefits, with a marginal cost of $68 million per cancer case averted. Promulgating 80 μg/L instead of 30 μg/L as the MCL would have saved $36.4 million while reducing the number of cancer cases averted by 0.35, a marginal cost of $190 million per cancer case. It is possible that 80 μg/L (or 30 μg/L, the MCL promulgated) would have been economically feasible for very large systems. However, uranium is not a significant constituent in source waters used by very large systems, so it is probable that the rule was economically feasible for no water system.

Similarly, the arsenic MCL (10 μg/L) was estimated to yield negative aggregate net benefits at every MCL examined. The MCL was economically feasible for systems serving ≥ 1 million persons under fairly broad conditions, however. Under several restrictive conditions (3 % discount rate, upper-bound arsenic exposure, average household size ≥ 5), the MCL may have been economically feasible for the 10,001–50,000 person system size category. These restrictions are so significant – especially the minimum average household size – that no systems in this size category probably qualifies.

The 1991 lead and copper rule (LCR) was estimated by USEPA to cost systems $460–$750 million per year and States $40 million per year (USEPA, 1991, table 20). USEPA did not report benefit and cost estimates for the 2000 LCR revision (USEPA, 2000a), so no inferences can be gleaned concerning the specific effect of the economic feasibility principle had it been adopted.[9] Abernethy et al. (2018) addresses the high cost of simply determining where lead service lines exist and developing a cost-effective strategy for line replacement. The USEPA Science Advisory Board (2011) has raised concerns that service line replacement may increase rather than reduce risk. This has obvious relevance under the economic feasibility principle, but it is immaterial if technological feasibility alone controls decision-making. USEPA's forthcoming Long-Term LCR (USEPA, 2018a), which purports to overcome limitations that made the 2000 regulation ineffective, has been estimated to cost another $44–274 million per year (Slabaugh et al., 2015, table 6), with annual costs rising exponentially as system size declines (Slabaugh et al., 2015, fig. 5).

5.4 Summary

If USEPA had adopted the economic feasibility principle after SDWA 1996, the entire portfolio of SDWA 1996 regulations would have looked very different.

9 USEPA acknowledged in the 1991 LCR that it did not take benefits into account in setting the NPDWR. See USEPA (1991).

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USEPA would have set MCLs such that they were economically feasible for the smallest system size subject to regulation. The Agency would have made tradeoffs between stringency and regulatory scope. These tradeoffs would have been more striking if the Agency had also complied with the relevant SDWA 1996 provisions governing objective risk assessment and benefit cost analysis.

Allocative inefficiency would have been reduced or avoided to an extent dependent on the objectivity of USEPA's risk and economic analyses. Cost-savings would have totaled hundreds of millions of dollars annually. These savings would have enabled systems to better fund key infrastructure improvements, and households would have had greater disposable income for more highly valued uses.

Post-1996 drinking water regulations, like those that preceded SDWA 1996, imposed gross inequities on nonmetropolitan areas, low-income communities, and low-income households. The economic feasibility principle would have substantially attenuated these inequities. The poor would not have borne disproportionately high and rising costs for drinking water, and drinking water regulation would not have made them poorer with each successive regulation action.

6 Conclusion

The SDWA has been implemented in ways that cause significant allocative inefficiency by subordinating economic feasibility to stringent standards regardless of health benefits. Regulations also have achieved quantity-based equal protection against health risks at the cost of substantial unequal protection against financial risks, most notably on households served by small systems, less wealthy regions and States, low-income communities, and low-income households generally.

In SDWA 1996, Congress changed direction and permitted that USEPA promulgate standards supported by objective risk assessment and benefit-cost analysis such that costs are justified by benefits. Ceteris paribus, adoption of the economic feasibility principle would have led to less stringent MCLs, the exemption of smaller system sizes, or both. How USEPA would have traded off stringency for regulatory scope cannot be determined because policy choices delegated to the administrator can be informed but not determined by economic analysis.

It also appears that post-SDWA 1996 NPDWRs did not adhere to SDWA 1996 requirements for objective risk analysis and benefits assessment or Agency guidance on economic analysis (USEPA, 2000b, 2008, 2010). Each determination that benefits justified costs depended on estimating expenditures instead of opportunity costs, using risk analysis methods that were not designed to be compatible with benefit-cost analysis, or invoking speculative unquantified co-benefits to make up any difference between estimated benefits and estimated expenditures.

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USEPA can adopt the economic feasibility principle by regulation as the most reasonable interpretation of SDWA 1996. The Agency can set MCLs at the most health-protective level consistent with technological and economic feasibility for the smallest size system subject to regulation. Systems that can achieve more stringent controls in an economically feasible manner will be motivated to do so without a federal mandate. This includes both large water systems (for which even very stringent standards may be economically feasible because of economies of scale) and very small systems (which would be exempt because of their diseconomies of scale). The economic feasibility principle would balance customers' interests in protection from risk and their aversion to expenditures that exceed the value of benefits received.

In the economic analysis of a USEPA regulation outside the drinking water realm, Wagner (2009) detected a material bias favoring the Agency's preferred standard rather than a fair comparison of alternatives that could have informed the administrator's decision. Many of the economic analyses for post-SDWA 1996 regulations are consistent with Wagner's observations; none of the analyses contradicts it. This means adoption of the economic feasibility principle is likely to be an essential prerequisite for SDWA 1996-compliant standard setting, with the courts serving as arbiters of compliance with SDWA 1996 procedural requirements.

Supplementary material

To view supplementary material for this article, please visit https://doi.org/10.1017/bca.2019.21.

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Online Appendix to Richard Belzer, Achieving Economically Feasible Drinking Water Regulation[1]

This Appendix provides reviews of the economic feasibility of individual post-SDWA 1996 National Primary Drinking Water Regulations (NPDWRs), summarized in Section **Error! Reference source not found.**. Subsection (a) covers the cluster of regulations dealing with microbial risks, disinfection, disinfection byproducts, and disinfection-resistant pathogens. Subsection (b) summarizes NPDWRs for radionuclides, arsenic, and lead and copper. Subsection (c) summarizes miscellaneous drinking water regulations related to routine bacterial pathogens. Only those regulations in which USEPA asserted that benefits justified costs and conducted an economic analysis are included.

This review generally takes as given USEPA's benefit and cost estimates unless alternative estimates were readily available at the time, even when there are good reasons to doubt their accuracy (e.g., due to structural bias) or reliability (e.g., due to excess precision). Certain methodological errors were endemic, such as estimating expenditures instead of opportunity costs and calculating net benefits as the difference between opportunity-cost based benefits and expenditures. These errors are noted but generally ignored here because the objective is to ascertain whether prior adoption of the economic feasibility principle would have resulted in a different decision when all other factors are held constant. Thus, it is assumed that if the Agency had adopted and followed the economic feasibility principle it would not have used different data or analytic methods to estimate benefits and costs. It is further assumed that the

[1] The proposed online appendix is included here for readability.

relevant economic analyses were not reverse-engineered to "serve primarily as a mechanism for promoting agency decisions rather than scrutinizing them" (Wagner 2009, p. 56).

There is no practical way to review the Agency's work and draw inferences concerning what decisions it might have made under the economic feasibility principle where these assumptions do not hold or if superior analytic methods had been used. Nonetheless, it is clear that if USEPA had adopted and applied the economic feasibility principle, Maximum Contaminant Levels (MCLs) would have been less stringent, the minimum system size subject to regulation would have been larger, or some combination thereof. These effects would have been more pronounced if the Agency had estimated opportunity costs instead of expenditures, and objectively estimated risks and benefits as required by SDWA 1996 § 1412(b)(3)(A).

a. Microbial/Disinfection Byproducts Rule Cluster

USEPA formed the Microbial-Disinfection/Disinfection Byproducts Advisory Committee (M-DBP) in February 1997 as a follow-on regulatory negotiation (colloquially referred to as a "Reg Neg") to a similar proceeding conducted in 1992-93. The domain of the more recent Reg Neg included certain proposed rules specifically referenced in SDWA 1996 § 1412(b)(2)(C).

The suite of rules in this cluster seeks to address microbial risks through disinfection, countervailing risks posed by disinfection byproducts (DPBs) after disinfection, and microbial contaminants that are resistant to control by disinfection (principally *Cryptosporidium* and *Giardia*). Risks were estimated and characterized in accordance with standard Agency methods designed to ensure that they were not "*unrealistically* conservative" (Browner 1995, p. 3, emphasis added). This is an ambiguous but clearly different approach than required by SDWA 1996 § 1412(b)(3)(A)(i), which states that risk assessments must be objective. For example, in the Stage 1 Disinfection Byproduct Rule (Stage 1 DBPR), USEPA described the scientific

evidence that DBPs cause bladder cancer and reproductive and developmental effects as "inconclusive" (USEPA 1998f, p. 5-15). Nevertheless, the Agency assumed that there was an 80% probability that the weak associations with bladder cancer observed in some epidemiological studies were causal (USEPA 1998f, pp. 4-12 and 6-20, Exhibit 4.5).

In addition to the M-DBP, three Small Business Advocacy Review Panels (SBARs) were created pursuant to § 244 of the Small Business Regulatory Enforcement and Flexibility Act of 1974 (SBREFA 1996). Each panel included multiple stakeholders and nongovernmental experts (USEPA 2018c, 2018d, 2019). According to Raucher and Cromwell (2004), USEPA's *ex ante* compliance cost estimates were not controversial largely because of stakeholder participation. However, because USEPA predetermined that the MCLs for total trihalomethanes, haloacetic acids, and bromate that were proposed prior to SDWA 1996 would not be changed (USEPA 2009c, Sec. 2.1), the M-DBP and SBARs did not examine the rules' economic feasibility.

The two DBP rules were intended to reduce (primarily) bladder cancer risks assumed to result from exposure to disinfectants used to reduce certain pathogens. In 1996, bladder cancer incidence was 36.7 per 100,000 for men and 20.8 per 100,000 for women. NCI's SEER 9 data indicate that rates rose a statistically significant 0.2% from 1986-2007 and declined a statistically significant 1.1% from 2007-2015 (National Cancer Institute 2018a). Relative to the approximately 80,000 new bladder cancer cases per year reported (National Cancer Institute 2018b), the number of bladder cancer cases attributed by USEPA to drinking water disinfectants has been uncertain (USEPA 1998c, p. 69434) or small (USEPA 1998f, p. 4-21 [0–9,300]; 2005b, Exhibit 6.20 [275–874]). USEPA acknowledged that no causal relationship had been established (USEPA 2005b, p. 6-65).

The three surface water treatment rules and the ground water rule were intended to control cryptosporidiosis and giardiasis from parasites that are resistant to inactivation by disinfection. Cryptosporidiosis and giardiasis result from the ingestion of sufficient *Cryptosporidium* oocysts or *Giardia* trophozoites through the consumption of fecally contaminated food or water, or person-to-person or animal-to-person transmission (Fayer et al. 2000). Most cases go undiagnosed, few who are infected seek medical attention, hospitalization is rare. Mortality from cryptosporidiosis is rarer still and highly concentrated among immunocompromised subpopulations; mortality from giardiasis is virtually nonexistent (Painter et al. 2015a; Painter et al. 2015b; Centers for Disease Control and Prevention 2017c). Both parasites are endemic, but infections are associated with warm weather use of recreational water, which has been estimated to be responsible for 37% of all cases of cryptosporidiosis (Centers for Disease Control and Prevention 2017a, p. 14).

In 1999, incidence of cryptosporidiosis across the continental U.S. ranged from 0.1 to 7.2 cases per 100,000, with a mean of 1.0 case per 100,000 (Hlavsa et al. 2005). By 2011, the mean and range had grown to 3.0 and 17.7 per 100,000, respectively (Painter et al. 2015b). FDA's FoodNet (a nonrepresentative sample of 10 States comprising about 15% of the U.S. population) reported no statistically significant change in foodborne cryptosporidiosis incidence from 2006-13 (Gilliss et al. 2013; Crim et al. 2014). Underreporting is believed to be widespread because cryptosporidiosis and giardiasis are typically mild gastrointestinal infections, etiologic confirmation requires laboratory analysis, and confirmation of the underlying pathogen has no value added for guiding treatment decisions. Hospitalization is infrequent and mortality is rare, especially since the development of retroviral drugs to treat AIDS. From 2000-17, the average annual numbers of nationwide cryptosporidiosis and giardiasis cases were 7,274 and 16,747,

respectively (Centers for Disease Control and Prevention 2018a). The average annual numbers of nationwide mortalities were 1.74 and 0.42, respectively (Centers for Disease Control and Prevention 2018b).

Finally, two rules in this suite were intended to control potential viral and bacterial infections attributed to ground water used as drinking water. Like the other regulations, the causal nexus between drinking water and illness is unclear and estimated benefits are small.

USEPA risk assessment practices would have materially adverse effects on economic feasibility determinations in the same way they affect determinations that benefits justify costs. This is further discussed in 1.a.8 below.

1.a.1. Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR)

In this rulemaking, USEPA revised NPDWRs for disinfectants and DBPs, which included maximum residual disinfectant levels (MRDLs), maximum contaminant levels (MCLs), and treatment techniques. Community Water Systems (CWSs) and Non-Transient Non-Community Water Systems (NTNCWSs) were generally covered, and some provisions also applied to Transient Non-Community Water Systems (TNCWSs). MRDLs and MCLs were based on technological feasibility (USEPA 1998c); cost played no role. Nonetheless, the Agency asserted that the benefits of the rule justified the costs, thus making this rule potentially susceptible to economic feasibility analysis.

USEPA estimated aggregate expenditures for treatment and monitoring at $701 million ($1998, annualized at 7%) including capital, operations and maintenance, and monitoring (USEPA 1998c, Table IV-6). Expenditures for DBP control depended on technology and system size. The range across technologies for surface water systems was as great as 162x, and the range across system sizes was as great as 608x. Similar variability was reported for ground water

systems (USEPA 1998c, Tables IV-4 and IV-5). Raucher and Cromwell (2004) estimated that 40% of expenditures would be borne by systems serving fewer than 10,000 persons.

Nearly 12,000 such systems were expected to be required to modify their treatment trains and 62,000 small systems were expected to expend significant new resources to collect over 1 million new monitoring samples (USEPA 1998f, Exhibits 5.8 and 5.9). An estimated 96% of CWSs and NTNCWSs serve fewer than 10,000 persons, and 22% of them were estimated to bear additional costs. About 8,200 small groundwater systems and 3,600 surface water systems were estimated to expend about $1 billion and $240 million in capital improvements, respectively, for modified treatment.

USEPA analyzed small-system cash flow and viability to gain insight on the risk of financial failure, a proxy for system affordability. USEPA acknowledges that small systems would have preferred that the Agency promulgate different standards for large and small systems to avoid small-system nonviability and forced consolidation, but the Agency did not analyze these options and there is no evidence that it gave them serious consideration (USEPA 1998f, pp. 5-23 to 5-25). The Agency's economic analysis does not consider forced consolidation with larger systems to be a social cost because consolidation is a longstanding Agency goal (USEPA 1998f, pp. 5-19 to 5-23).

The Agency acknowledged that benefits were "difficult to quantify because of the uncertainty associated with risks from exposure to DBPs (and the resultant reductions in risk due to the decreased exposure from DBPs)" (USEPA 1998c, p. 69434). These uncertainties include a nine-fold range in the Agency's estimated number of bladder cancer cases caused by DBPs, plus an acknowledgement that the true number of cases could be zero (USEPA 1998c, Table IV-8; 1998f, Exhibit 6.3c). Estimated aggregate annual benefits ranged from $0 to $4 billion, with the

upper-bound implying a 24% reduction in new bladder cancer cases resulting from a 24% reduction in exposure (USEPA 1998f, p. 6-1). No cessation lag appears to have been applied.

USEPA's net benefit estimates were derived by subtracting a range of expenditures ($500–$900 million) from the $0–4 billion range of opportunity cost-based health benefits. The Agency described these ranges as "overlapping," thus providing a "substantial basis" for the rule (USEPA 1998f, p. 6-2). Net benefits depended on the number of annual bladder cancer cases prevented, and USEPA acknowledged that taking no action is a superior choice if the number of cases prevented is less than a figure somewhere between 1,000 and 2,500 per year (USEPA 1998f, Exhibit 6.2).

In the end, USEPA concluded that "there is a reasonable likelihood that the benefits will exceed the costs" (USEPA 1998c, p. 69434), and that the rule was "needed for protection of public health from exposure to DBPs" due to the extent of potential exposure, evidence of DBP carcinogenicity and reproductive or developmental harm in laboratory animals at high doses, and weak associations in some epidemiological studies (USEPA 1998f, p. 5-15). Thus, the new standards were grounded in precaution with respect to *potential* health risks without regard for *actual* opportunity costs.

The extent to which prior adoption of the economic feasibility principle would have enhanced efficiency or reduced inequity cannot be determined based on the information disclosed, however. The selected alternative was the only one examined in the economic analysis (USEPA 1998f, p. 6-3) and only nationwide estimates of benefits and costs were reported, without disaggregation by system size, region, or other key factors. However, if USEPA had adopted the economic feasibility principle *and* followed the risk- and economic analysis

requirements in SDWA 1996, the Agency would have either adopted less stringent standards or declined to modify existing standards.

1.a.2. Interim Enhanced Surface Water Treatment Rule (IESWTR)

The IESWTR (USEPA 1998d) was a response to the 1993 cryptosporidiosis outbreak in Milwaukee, which was attributed to a sudden increase in *Cryptosporidium* in source water at the intake for the treatment plant on the city's south side combined with treatment failure (Fox and Lytle 1996). Turbidity (a measure of suspended particulates, and thus a proxy for *Cryptosporidium*) in finished water increased from about 0.4 nephelometric turbidity unit (NTU) to a peak of 2.7 NTUs at the height of the crisis (Fox and Lytle 1996, p. 92 and Figure 2). Turbidity is an imperfect indicator of *Cryptosporidium*; other water systems utilizing Lake Michigan also experienced increases in turbidity but did not have a cryptosporidiosis outbreak (Fox and Lytle 1996, p. 94 and Table 1).

Using a RDD telephone survey, Mac Kenzie et al. (1994) estimated more than 400,000 persons were "affected" by the outbreak; cryptosporidiosis was clinically confirmed in more than 600 people. Cryptosporidiosis can be "unrelenting and fatal" in those who are immunocompromised (p. 161). Hoxie et al. (1997) report that AIDS was the underlying cause of death recorded in 46 (85%) of the 54 cryptosporidiosis-associated fatalities. AIDS mortality declined for about 18 months thereafter, then resumed its previous upward trend. Hlavsa et al. (2005) reported that cryptosporidiosis-associated fatalities among HIV-infected subpopulations decreased substantially after the Milwaukee outbreak due to the contemporaneous introduction of effective antiretroviral therapy.

IESWTR required water systems serving at least 10,000 persons that relied on surface water sources to use a treatment technique in lieu of achieving an MCL, and meet other

regulatory controls (USEPA 1998d). Increasing the stringency of turbidity control was assumed to reduce *Cryptosporidium* and *Giardia* in finished water. The Agency asserted that the regulation's benefits justified the costs (USEPA 1998d, pp. 69499, 69509), so the rule is potentially susceptible to economic feasibility analysis.

For benefit estimation, USEPA relied on health risk-precautionary risk assessment methods and data from the Milwaukee outbreak (USEPA 1998e, § 4.2); cost of illness (COI) valuations derived from previous survey research on giardiasis (Harrington et al. 1985); and assumptions about the effectiveness of turbidity reduction in removing *Cryptosporidium* oocysts (USEPA 1998e, § 4.2.4).

The Agency's mid-level estimates of regulatory effectiveness were annual reductions of 432,000 illnesses and 60 deaths (USEPA 1998e, Exhibits 4.12 and 4.16). However, the number of illnesses and deaths reported from all pathways in 1998 was 3,111 and zero, respectively (Centers for Disease Control and Prevention 2018a). Fewer than two deaths per year were reported for 1999-2017 (Centers for Disease Control and Prevention 2018b). USEPA's risk model did not account for reductions in mortality among immunocompromised individuals resulting from the inexpensive implementation of certain best practices (e.g., bottled water) or antiretroviral therapy for AIDS. Even before the ISESTWR was promulgated, it was suspected that the underlying cause of the Milwaukee outbreak was a failure in sewage treatment upstream of the drinking water intake (Peng et al. 1997).

USEPA reported estimated aggregate annualized expenditures of $596 million for disinfection and $189 million for turbidity reduction (both $1998, 7%), the latter expenditure substantially varying by system size (USEPA 1998e, Tables V.1 and V.2). USEPA's affordability doctrine figured implicitly in the Agency's household-level expenditures, which

were $12 or less per year for 92% of households; $12–60 per year for 7% of households; and "approximately $100 per year" for the remaining 1% of households (USEPA 1998e, Figure V.1; 1998e, p. 5-25). No further breakdown by system size was provided. The economic analysis included a brief, qualitative opportunity-cost justification of the lower-end of these estimated household-level expenditures (USEPA 1998e, ES-6). Aggregate expenditure estimates were reported to span ± 30% (USEPA 1998d, p. 69437).

The Agency reported opportunity-cost based benefit estimates that varied depending on the assumed number of illnesses and mortalities avoided, and the level of *Cryptosporidium* removal (USEPA 1998e, Table V.4). Regulatory effectiveness was acknowledged to be highly uncertain. The number of illnesses estimated by USEPA to be prevented ranged from zero to 1.029 million, and the estimated number of fatalities prevented ranged from zero to 129. Illnesses were valued at $2,000/each using COI methods. Premature mortalities, concentrated among immunocompromised persons, were valued using the then-applicable VSL (USEPA 1998e, ES-4).

Several potential unquantified benefits also were mentioned (USEPA 1998d, p. 69501). Unquantified costs were not discussed and opportunity costs were not estimated, however. Thus, to conclude that benefits justified costs, USEPA relied on a range of *opportunity-cost derived* benefit estimates ($0–$2.7 billion) encompassing a point estimate of annualized *compliance* expenditures ($633 million) (USEPA 1998d, p. 64509; 1998e, pp. ES-7). The relative probabilities of these estimates were not taken into account.

Like in the case of the Stage 1 DBPR, savings from prior adoption of the economic feasibility principle cannot be determined based on the information disclosed. Moreover, USEPA's decision appears to have been driven by its internal policy preferences for precaution

with respect to uncertain risks (but not certain costs) and quantity-based equity. Finally, as discussed in 1.a.8 below, USEPA's estimated numbers of illnesses and deaths from cryptosporidiosis prevented significantly exceed estimates of baseline illnesses and deaths reported by CDC.

1.a.3. Filter Backwash Recycling Rule (FBRR)

During the consideration of SDWA, Congress became aware of concerns that the routine recycling of filter backwash water could inadvertently result in recontamination of finished water. SDWA 1996 § 1412(b)(14) directed USEPA to manage this risk, which it did via the FBRR (USEPA 2001b). Annualized costs were estimated at about $7 million ($2000, 7%) (Exhibit 6-5). Raucher and Cromwell (2004) note that post-promulgation cost estimates were considerably higher. Potential benefits were described qualitatively, so the Agency's determination that benefits justified costs was qualitative as well (USEPA 2001d, p. 31096; 2000b, p. 8-2). The potential effects of having relied on the economic feasibility principle cannot be estimated without quantitative benefit estimates.

1.a.4. Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)

This regulation extended the IESWTR to systems serving fewer than 10,000 persons (USEPA 2002b). The Agency determined that the benefits of the regulation justified the costs (USEPA 2002b, p. 1827), making this rule potentially susceptible to economic feasibility analysis.

USEPA estimated combined annualized system and State compliance expenditures at $44.8 million ($1999, 7%) (USEPA 2002b. p. 1822). Key expenditures (e.g., for land acquisition) and opportunity costs generally (e.g., the value of owned land newly committed to

treatment) were not estimated. System-level expenditures were assumed to be passed through to households. Annual expenditures per household were estimated at $6.24 (mean), $15.00 (90th percentile), $15–$120 (91st to 98th percentile), and over $120 for the 99th percentile. Expenditures were estimated to exceed $240 per year for 5,600 households. USEPA reported having estimated benefits for three assumed risk levels and two baseline assumption for pre-regulation cryptosporidium removal. Illness cases were valued at $796–$1,411 per case based on the cost of treating giardiasis (an illness of longer duration), and mortalities were valued at the then-applicable VSL.

USEPA's reported net benefit calculations subtract a point estimate for annualized expenditures ($44.8 million) from a range of opportunity-cost based benefits ($18.9–$90.9 million) (both $1999). The extent to which adoption of the economic feasibility principle would have reduced costs or increased net benefits cannot be determined from the information made public because key analytic documents (USEPA 2000g, 2001a) referenced in the preamble to the final rule were not included in the docket and are not electronically available to the public despite an aggressive Google search. Finally, as noted in Section 1.a.8 below, USEPA's estimated numbers of illnesses and deaths from cryptosporidiosis prevented significantly exceed the numbers of illnesses and deaths from all pathways reported by CDC.

1.a.5. Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR)

This regulation expanded upon the Stage 1 DBPR, targeting systems in compliance but with peak concentrations greater than Stage 1 MCLs (USEPA 2006a). Aggregate annualized system expenditures were estimated at $76.8 million ($2003, 7%) for nine system-size categories (USEPA 2006a, p. 445). Unquantified costs were not identified (USEPA 2005b, p. 7-47). Increases in mean household-level expenditures were estimated at $4.58 or less, depending on

system size (USEPA 2006a, Table VI.E-1), and appear to be consistent with the affordability doctrine. Opportunity costs to systems or their customers were not estimated.

Annualized benefit estimates consist of the value of "reasonable estimate[s] of the range of potential [bladder cancer] risks" from peak DBP exposure, acknowledging that "the existing epidemiological evidence has not conclusively established causality between DBP exposure and any health risk endpoints." USEPA acknowledged that "potential risks may be as low as zero" but nevertheless assumed causality. The Agency attributed 2–17% of baseline bladder cancer cases to DBPs (USEPA 2006a, p. 444). Depending on the risk model used (all of which excluded zero risk), the estimated number of cancers prevented ranged from 61 to 610 (USEPA 2006b, Table VI.C-1).

Unquantified benefits are discussed, notably reproductive and developmental risks derived from "possible associations" reported in certain epidemiological studies described as having "mixed" results (USEPA 2006a, p. 391). USEPA further asserted that the rule might provide these additional benefits because "a weight of evidence evaluation of the health effects data suggests a potential association" (USEPA 2005b, p. ES-11). USEPA's net benefit calculation was positive (Table VI.F-1), but as before was obtained by subtracting *virtually certain expenditures* from the value of *potential benefits*. The number of cancers that must be prevented to cover annualized opportunity costs cannot be calculated because opportunity costs were not estimated.

Adoption of the economic feasibility principle may have yielded a substantially different decision because risk and benefit per person are assumed to be linear while expenditures per person vary greatly by broad system size category, as shown in

Table 0-1 below.[2] Mean annualized expenditures per household range from $2.83 to $49.69 per year, a span of more than 17x, depending on system size. At the 90th percentile, estimated household expenditures range from $6.98 to $173.53, a factor of 25x. Detailed results by system size are reported in an appendix to USEPA (2005b) that is not publicly available, however.

USEPA acknowledged that the scope of potential exposure (> 260 million persons) "played a significant role" in its decision to promulgate the Stage 2 DBPR, not the strength of evidence for risk. USEPA also described the rule as necessary to ensure "more consistent, equitable protection from DBPs" (USEPA 2006a, p. 391), thus indicating that achieving quantity-based equity was a significant consideration.

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Table 0-1: Stage 2 DBPR: Annualized Expenditure Increases per Household, Breakeven Annualized Cancer Cases per household, and Breakeven Minimum Households per Cancer Case Avoided

Annualized Expenditure/ Household	System Category	Breakeven Minimum Annualized Cancer Cases per Household	Breakeven Minimum Households per Cancer Case Avoided
AVERAGE			
$ 2.83	SW > 10k	2.53×10^{-6}	395,505
$ 49.69	GW < 10k	4.44×10^{-5}	22,525
90th PERCENTILE			
$ 6.98	SW > 10k	6.24×10^{-6}	160,355
$ 173.53	SW < 10k	1.55×10^{-4}	6,450
Derived from USEPA (2005a). Value of prevented fatal and nonfatal bladder cancer = $2.028 million and $0.8 million, respectively. Proportion of bladder cancers assumed fatal = 26%.			

1.a.6. Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR)

This regulation expanded regulatory requirements for the treatment of surface waters used for drinking water for the control of *Cryptosporidium* and other microbial pathogens resistant to disinfection (USEPA 2006b). The rule targeted systems that rely on surface waters with unusually high *Cryptosporidium* occurrence (not concentration) rates; subjected to treatment requirements systems that previously were not required to filter; and required existing finished water storage reservoirs to be covered. USEPA determined that benefits justified the costs (USEPA 2006b, p. 748), thus making the rule potentially susceptible to economic feasibility analysis.

USEPA examined three alternatives besides the Agency's preferred alternative (A3) (USEPA 2005a, Chapter 3), which the Agency described as "the most cost-effective and [] deliver[ing] the best value" (USEPA 2005a, p. 3-3). These alternatives vary principally by monitoring frequency, with resulting treatment expenditures determined by monitoring results. No formal alternatives were examined with respect to provisions that were agreed upon through the Stage 2 M-DBP Reg Neg. Compliance with the LT1ESWTR was assumed in the analytic baseline.

Selected point estimates for aggregate compliance expenditures (not opportunity cost) are provided in Table 0-2. Estimates of annualized household-level expenditures generally were not clearly inconsistent with the affordability doctrine, though expenditures for households at the upper end might not have been affordable (USEPA 2005a, Exhibit ES.8-3). Unquantified costs were briefly discussed but not otherwise accounted for (USEPA 2005a, pp. 6-33 to 6-34).

Quantified benefits consist of estimated averted illnesses and deaths, which were valued at $844 and $7.4 million per case ($2003), respectively, for three different data sets that the

Agency said were "equally likely to represent the true distribution of *Cryptosporidium* in source waters for all systems" (USEPA 2005a, ES-8). Depending on the data set, estimated annual cases (deaths) averted ranged from 146k to 500k (38 to 130), a range of 3.4x. (USEPA 2005a, Exhibits 5.16 and 5.17). Risk was estimated using a simulation model (USEPA 2005a, § 5.2). Certain forms of variability and uncertainty (e.g., exposure via drinking water) were captured by stochastic distributions. Uncertainty about morbidity subsequent to exposure and mortality subsequent to infection are modeled as assumptions. Thus, estimated benefits critically depend on the accuracy of these embedded assumptions. As noted in Section 1.a.8 below, all model outputs of illnesses and deaths prevented significantly exceed the numbers of cases and deaths from all pathways reported by CDC.

Morbidity and mortality were valued using cost of illness (COI) methods and WTP, respectively, under multiple scenarios reflecting substantial uncertainty about hazard, dose-response, exposure, risk model structure, and limited data (USEPA 2005a, Chapter 5). The estimated numbers of illnesses averted were reported with up to seven significant figures, ranging from 363,328 to 1,501,445, depending on risk model and regulatory alternative/data set combination (USEPA 2005a, Exhibit 5.5). The Agency modeled illness risk from *Cryptosporidiosis* exposure as a triangular distribution (30%, 50%, 70%), and further assumed that the probability of mortality given illness was 24.07 per 100,000 illnesses among AIDS patients served by unfiltered systems, 14.56 per 100,000 illnesses for AIDS patients served by filtered systems, and 1.98 deaths per 100,000 for all others, with no uncertainty (USEPA 2005a, p. 5-22).

Risk and benefit estimates were disaggregated to reflect variability by system type and size, baseline filtration, and *Cryptosporidium* occurrence. The Agency also provided an

extensive discussion of potential unquantified benefits. Mean net benefits were calculated by subtracting expenditures from opportunity-based benefit estimates, and were positive for most scenarios using both conventional and "enhanced" COI methods (USEPA 2005a, Exhibit 8.12a, b). The reported dominant uniform regulatory alternative depends on the choice of data set and discount rate (3% and 7% were examined), but uncertainty in the illness risk component of the model clearly dominates both data set choice and discount rate. Small changes in the parameters of the triangular distribution would swamp estimated reductions. Moreover, any validity that might have attached to USEPA's results was vitiated by the assumption that qualitative benefits were five times as great as quantified benefits (USEPA 2006b, Table VI.C-1; 2005a, p. 8-21).

The likely effect of the economic feasibility principle is difficult to ascertain because the Agency's analysis was structured in ways that made estimated net benefits more likely. In addition, detailed estimates are needed by system size to determine where to draw the line between covered and exempt systems. USEPA analyzed benefits and costs by system-size categories but only reported aggregate estimates in the main analysis. Twenty-one appendices to the economic analysis contained, among other things, the Agency's analysis of small-system impacts. They are not publicly available.

Table 0-2: USEPA-estimated Aggregate Annualized Expenditures for LT2ESWTR

Data Set [a]	Total Annualized Costs $M (3%)			Total Annualized Costs $M (7%)		
		90% Confidence Bound [b]			90% Confidence Bound [b]	
	Mean	Lower (5th %ile)[b]	Upper (95th %ile)[b]	Mean	Lower (5th %ile)[b]	Upper (95th %ile)[b]
ICR	$133	$111	$160	$150	$125	$181
ICRSSL	93	72	112	107	83	129
ICRSSM	106	86	126	121	99	144

Source: (USEPA 2005a, Exhibit 8.5]).
[a] ICR = 1996 Information Collection Rule; ICRSSL = ICR Supplemental Surveys (Large Systems); ICRSSM = ICR Supplemental Surveys (Medium-Size Systems).
[b] Meaning of 5th and 95th percentiles with 90% confidence bounds is not explained.

Table 0-3: LT2ESWTR: USEPA-estimated Annual Illnesses and Deaths Avoided

Data Set [a]	Annual Illnesses Avoided			Annual Deaths Avoided		
		90% Confidence Bound [b]			90% Confidence Bound [b]	
	Mean	Lower (5th %ile)[b]	Upper (95th ile)[b]	Mean	Lower (5th %ile)[b]	Upper (95th ile)[b]
Annual Total after Full implementation						
ICR	964,360	149,241	2,277,367	207	34	468
ICRSSL	230,730	38,281	521,925	52	9	113
ICRSSM	455,170	72,128	1,112,374	100	17	230
Annual Average over 25 Years						
ICR	712,732	109,486	1,685,176	154	25	348
ICRSSL	170,977	28,314	392,979	39	7	85
ICRSSM	336,652	52,763	826,004	74	12	172

Source: (USEPA 2005a, Exhibit 8.3]).
[a] ICR = 1996 Information Collection Rule; ICRSSL = ICR Supplemental Surveys (Large Systems); ICRSSM = ICR Supplemental Surveys (Medium-Size Systems).
[b] Meaning of 5th and 95th percentiles with 90% confidence bounds is not explained.

1.a.7. Ground Water Rule (GWR)

This regulation added an additional layer of treatment requirements for ground water systems believed by USEPA to be susceptible to fecal contamination "because such contamination is the likely source of viral and bacterial pathogens in drinking water supplies" (USEPA 2006f, p. 65576). USEPA determined that the risk-targeting strategy was cost-effective (USEPA 2006d, Chapter 8) and that the benefits justified the costs (USEPA 2006f, p. 65637). Thus, this rule is potentially susceptible to economic feasibility analysis.

The regulation's "risk-targeting strategy" included triennial or quintennial sanitary surveys with survey-triggered monitoring requirements, mandatory corrective action by treatment, and compliance monitoring. Costs were estimated conventionally based on paperwork, recordkeeping, and engineering expenditures, not opportunity costs. Benefits were based on potential risks and estimated using both "traditional" and "enhanced" COI methods. "Enhanced" methods included the value of lost nonmarket work time based on opportunity costs, the value of lost leisure time, and the value of lost productivity (USEPA 2006d).

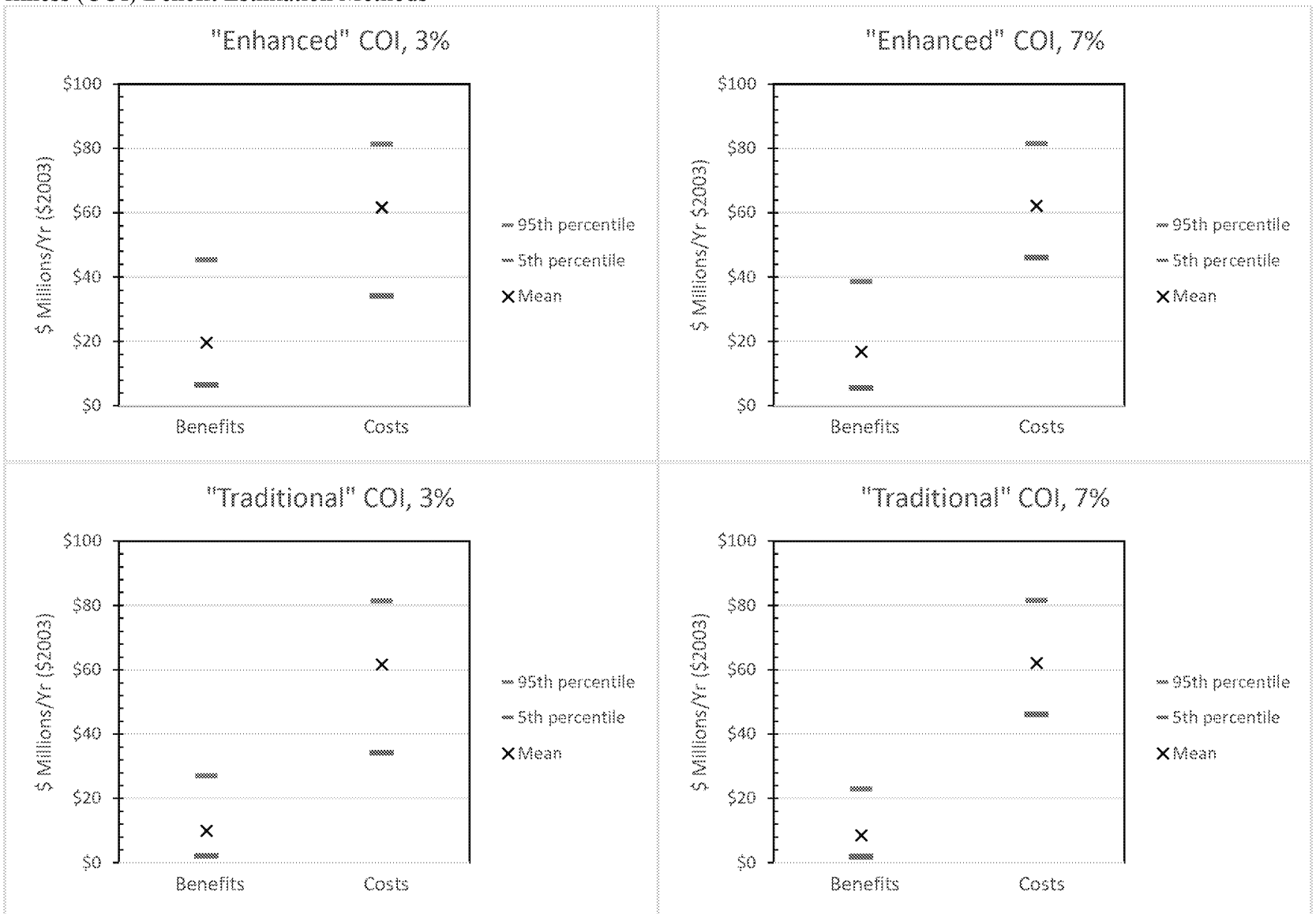
Figure 0-1 shows USEPA estimates of benefits and costs of the selected regulatory alternative for two benefit estimation methods ("enhanced" and "traditional" COI) and two discount rates (3% and 7%) (USEPA 2006f, Table VII-1). Aggregate net benefits at the mean, 5th percentile, and 95th percentile were negative regardless of dataset, discount rate, and COI methodology.

The determination that benefits justified costs depended on substantial unquantified co-benefits and the virtual absence of unquantified costs. Unquantified co-benefits were assumed to be at least four times greater than quantified benefits (USEPA 2006d, § 5.4.3.2). Unquantified

costs were assumed to be minor (USEPA 2006d, § 6.6). Three alternatives were analyzed, and aggregate net benefits also were negative for each. Alternative 1 had the smallest negative net benefits (–$11.7 million $2003 at 3%; –$12.4 million $2003 at 7%) (USEPA 2006d, Exhibit 8.10a).

Net benefits objectively estimated would have been more severely negative. As noted in Section 1.a.8 below, USEPA's estimates of illnesses and deaths prevented were significantly greater than the baseline numbers of cases and deaths from all pathways reported by CDC. USEPA's institutional reliance on risk assessment methods that yield upwardly biased estimates of risk (U.S. EPA Office of the Science Advisor 2004) result in upwardly biased estimates of benefits.

Figure 0-1: Ground Water Rule: USEPA-Estimated Benefits and Costs at 3% and 7% using “Enhanced” and “Traditional” Cost of Illness (COI) Benefit Estimation Methods



1.a.8. Analytical deficiencies adversely affect determinations of economic feasibility

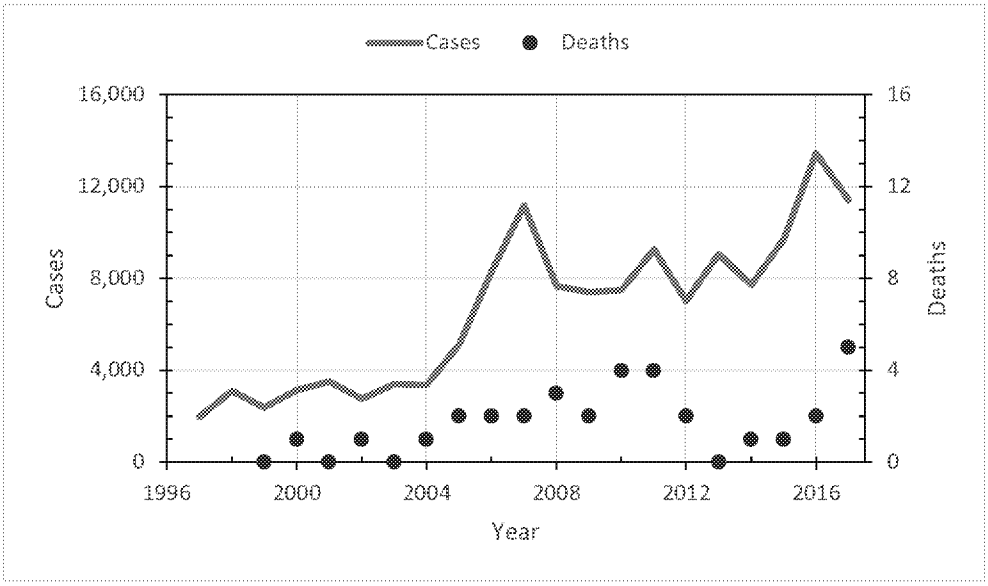
Several of these rules sought to reduce illnesses and fatalities potentially attributable to pathogens not amenable to risk-reduction through disinfection, such as *Cryptosporidium* and *Giardia*. Drinking water may be a key vector in the transmission of these pathogens, but not in the United States. Worldwide incidence of cryptosporidiosis has been estimated at 69.7 cases per 1,000 children aged < 5 worldwide, resulting in 4.2 million acute disability-adjusted life-years (DALYs) and 48,300 fatalities. U.S. incidence, however, is estimated at 0.2 cases per 1,000 children (99.7% lower), 31 DALYs (99.999% lower), and zero deaths (Khalil et al. 2018). Figure 0-2 shows that the number of reported U.S. cases rose from about 2,000 in 1997 to about 12,000 in 2017, but the number of deaths remained rare and exhibited no upward trend. Figure 0-3 shows a rising incidence rate of cryptosporidiosis but no change in the fraction of illnesses leading to death. Figure 0-4 shows a declining incidence rate for giardiasis, from about 20,000 cases per year in 2010 to about 16,000 cases per year in 2016. Reported deaths from giardiasis have never exceeded a single case per year.

The numbers of illnesses and deaths claimed to be prevented by the suite of surface water treatment rules greatly exceeds the total number of illnesses and deaths reported. In its analysis of the 2006 LT2ESWTR, USEPA estimated 154k to 2.3 million annual cases of cryptosporidiosis would be *prevented*, over and above the numbers of cases prevented by the 1998 IESTWR, 2001 FBRR, and 2002 LT1ESWTR. But the annual average number of cases *reported* since 1997 is 6,590. This is 10% of the lower-bound estimate and 0.5% of the upper-bound estimate of the number of cases prevented by LT2ESWTR alone. The Agency estimated 7 to 468 deaths would be prevented annually, but the average annual number of deaths reported from all pathways since 1999 is 1.74.

USEPA's estimates of benefits from avoided giardiasis are similarly inconsistent with empirical data. The Agency describes giardiasis reduction as a qualitative benefit in the IESTWR (USEPA 1998c, the FBRR (USEPA 2000b), LT1ESWTR (USEPA 2002b), and LT2ESWTR (USEPA 2005a). But Figure 0-4 shows a negligible number of deaths and a declining number of illnesses from giardiasis from all pathways since 2002, and Figure Ad shows no change in the already low fraction of giardiasis cases resulting in death.

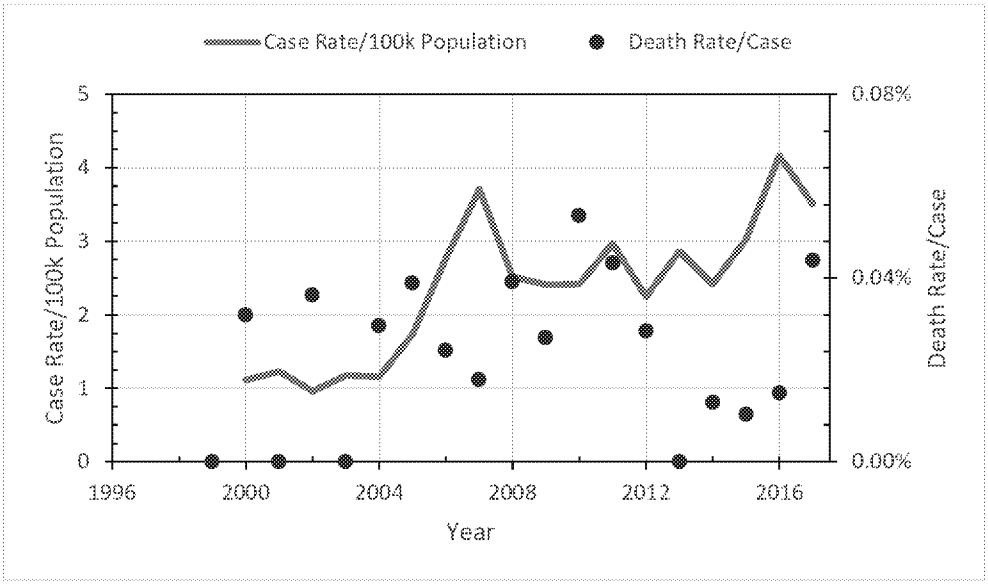
A plausible case might be made that the vast majority of cryptosporidiosis and giardiasis cases are too minor to seek medical attention, and thus are significantly underreported (Hlavsa et al. 2005). But if this is true, the Agency's unit valuation of the benefit of preventing a case of illness seems overstated. Meanwhile, deaths from cryptosporidiosis and giardiasis are much less likely to be underreported, and the gap between reported and model-predicted deaths is more troubling. The upper-bound estimate of the number of cryptosporidiosis deaths prevented by just one of the surface water treatment rules is 270 times the average annual number of baseline deaths reported from all pathways. Even small downward adjustments in the model would result in benefits that are considerably below expenditures, and well below opportunity costs.

Figure 0-2: U.S. Cryptosporidiosis Incidence, 1997-2016



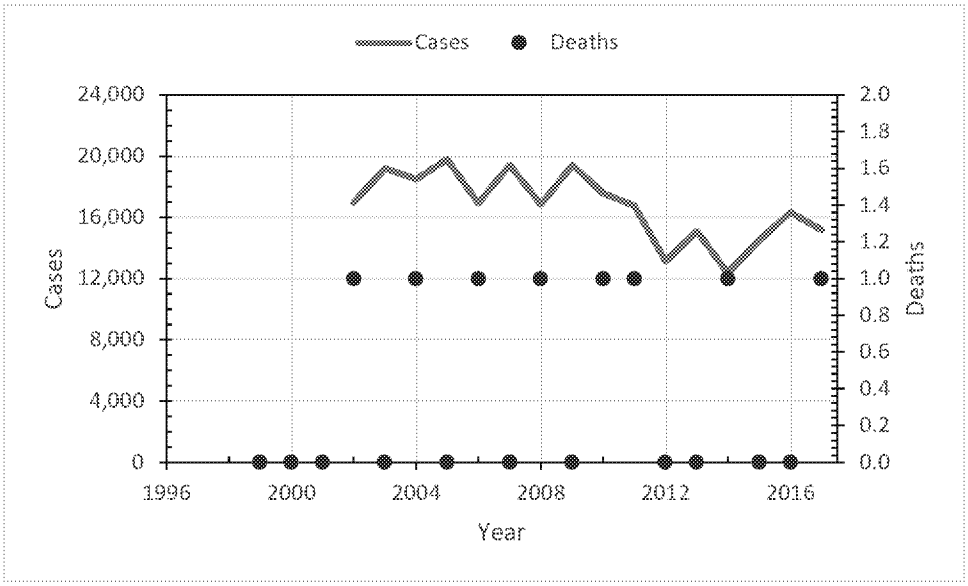
Sources: Centers for Disease Control and Prevention (2018a [cases]; 2017b [fatalities]).

Figure 0-3: U.S. Cryptosporidiosis Case Rate/100k Population & Death Rate/Case, 2000-2017



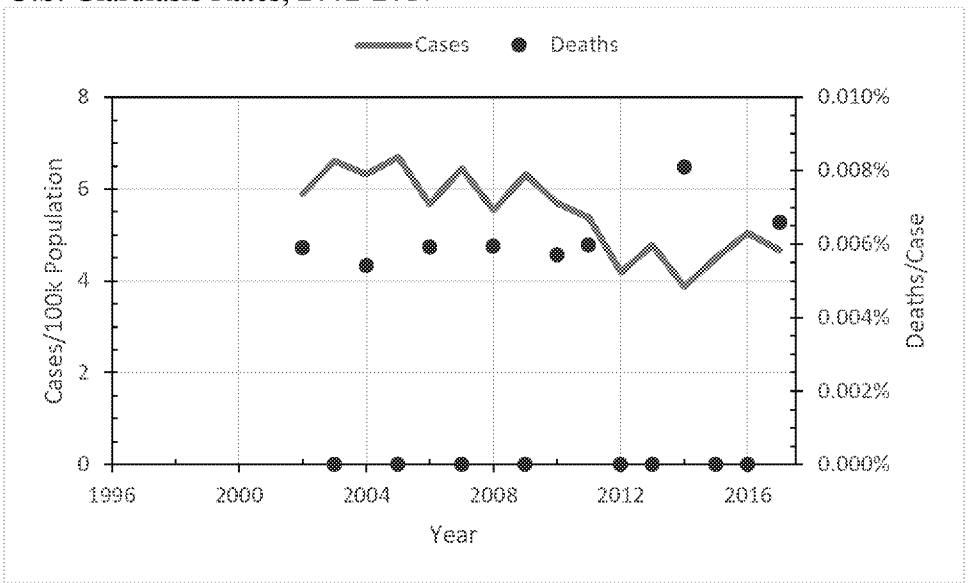
Sources: Centers for Disease Control and Prevention (2018a [cases]; 2017b [fatalities]).

Figure 0-4: U.S. Giardiasis Incidence, 1999-2016



Sources: Centers for Disease Control and Prevention (2018a [cases]; 2017b [fatalities]).

Figure Ad: U.S. Giardiasis Rates, 2002-2017



Sources: Centers for Disease Control and Prevention (2018a [cases]; 2017b [fatalities]).

b. NPDWRs for Other Contaminants

USEPA promulgated revised NPDWRs for three other contaminants since 1996. In each case, the adoption of the economic feasibility principle would have effectively eliminated inefficiency and substantially reduced inequity. Uniform MCLs would have been less stringent, the minimum system size subject to regulation would have been larger, or both. These effects would have been stronger if the Agency had estimated opportunity costs instead of expenditures, and objectively estimated risks and benefits as required by SDWA 1996 § 1412(b)(3)(A).

1.b.1. Radionuclides/Uranium NPDWRs

In 2000, USEPA revised the NPDWR for radionuclides by retaining the existing MCLs for combined Ra_{226} and Ra_{228} (though with intensified monitoring requirements), beta particle and photon emitters, and gross alpha activity; and promulgated a new 30 μg/L MCL for uranium. More stringent MCLs for radionuclides that the Agency had proposed were not promulgated because more recent research indicated that risk was lower than previously estimated (USEPA 2000d). At the same time, the Agency did not raise these MCLs on the ground that, in its view, SDWA 1996 § 1412(b)(9) forbids it from relaxing MCLs even if new science shows that the existing MCL was no longer scientifically supported. Economically feasible alternatives are likely to have been precluded by this policy decision.

The Agency stated that the uranium MCL represented the first time it was exercising the statutory authority delegated in SDWA 1996 § 1412(b)(6) to set a standard less stringent than the level it had determined was technologically feasible. USEPA asserted that benefits of the uranium MCL would not justify costs if it was set at 20 μg/L because of "relatively modest" risk reductions and "high annual compliance costs." However, the Agency also asserted that a 30

μg/L MCL "maximize[d] the health risk reduction benefits at a cost justified by the benefits" (USEPA 2000d, p. 76715). Thus, one would expect a 30 μg/L MCL to be economically feasible.

An objective reading of the rule, economic analysis, and Health Risk and Cost Analysis leads to a contrary conclusion, however. As shown in Table 0-4, estimated net benefits were negative for every alternative the Agency examined. Depending on the risk model, average cost per cancer case prevented ranged from $81 million to $182 million for the regulatory alternative USEPA rejected, and $60 million to $105 million for the regulatory option that "maximize[d] the health risk reduction benefits at a cost justified by the benefits." As shown in Table 0-5, costs were deemed to justify benefits at $68 million per cancer case avoided. The preamble to the final rules suggests that USEPA was primarily concerned about ensuring quantity-based equity, which it defined as achievement of *ex* post risk within its preferred (but non-statutory) 10^{-4} to 10^{-6} risk range (USEPA 2000d, pp. 76710-76716).

If USEPA had used the economic feasibility principle to set the uranium MCL, the Agency would have set it higher than 80 μg/L, which the Agency estimated would cost on average about $11 million per cancer case avoided (USEPA 2000c, p. 6-5).[3] Setting the MCL at 80 μg/L would have reduced USEPA's "best estimates" of compliance cost by $36.4 million and reduced the number of cancer cases prevented by 0.35 case (USEPA 2000c, Exhibit 7-7).

[3] USEPA (2000a) and (USEPA 2000h) have somewhat different estimates of the average cost per cancer case avoided. These differences are too small to affect the inferences drawn here, however. Estimates by system-size were not reported, but it is reasonable to infer that 30 μg/L would have been economically feasible for very large water systems.

Table 0-4: Radionuclides NDWPR: Comparison of Quantified Annual Costs and Benefits

Regulatory Option	Directly Proportional Hazard Model		Lognormal Distribution Hazard Model		"Best Estimate"	
	Cost/Cancer Case Avoided	Net Benefits	Cost/Cancer Case Avoided	Net Benefits	Cost/Cancer Case Avoided	Net Benefits
Compliance with existing MCLs after closing monitoring loopholes (combined radium = 5 pCi/L, gross alpha = 15 pCi/L)						
Eliminate gross alpha monitoring loophole only	$35.0 million	($1.2 million)	$79.1 million	($26.4 million)	$73.0 million	($13.8 million)
Eliminate combined radium monitoring loophole only	$51.6 million	($14.8 million)	$64.6 million	($32.7 million)	$59.3 million	($23.8 million)
Eliminate both loopholes	$50.9 million	($15.0 million)	$71.3 million	($57.9 million)	$65.8 million	($36.4 million)
Compliance with new uranium MCL options						
20 µg/L	$182.1 million	($25.0 million)	$81.4 million	($148.0 million)	$87.8 million	($86.4 million)
30 µg/L	$105.0 million	($6.1 million)	$58.9 million	($87.0 million)	$60.6 million	($46.6 million)
40 µg/L	$73.3 million	($2.1 million)	$46.3 million	($58.9 million)	$46.9 million	($30.5 million)
80 µg/L	$20.0 million	($0.1 million)	$27.7 million	($21.9 million)	$27.4 million	($11.1 million)
Source: USEPA (2000h, Exhibit 7-6).						

Table 0-5: Uranium NPDWR: Incremental Costs and Benefits for Alternative MCLs

Uranium MCL (µg/L)*_	Exposure Change (µg/L)*	Incremental Annual Cancer Cases Avoided*	Incremental Annual Compliance Costs ($M)*	Incremental Annual Monetized Cancer Benefits ($M)*	Incremental Number of Community Water Systems Affected*	Average Cancer Cases per Community Water System	Average Cost/CWS†	Average Incremental Costs/Cancer Case ($M) †
80	∞ to 80	0.5	$ 16	$ 2	100	0.0050	$ 160,000	$ 32
30	80 to 30	0.4	$ 38	$ 1	400	0.0010	$ 95,000	$ 95
20	30 to 20	0.2	$ 39	$ 1	290	0.0007	$ 134,483	$ 195
Incremental Costs and Benefits for Uranium MCLs of 30 µg/L and 20 µg/L only								
30	∞ to 30	0.8	$ 54	$ 3	500	0.0016	$ 108,000	$ 68
20	30 to 20	0.2	$ 39	$ 1	290	0.0007	$ 134,483	$ 195

* USEPA (2000c, Table 1-1).
† Derived from USEPA (2000c).

1.b.2. Arsenic NPDWR

In the preamble to the arsenic NPDWR (USEPA 2001b), USEPA reported having exercised the discretion in SDWA 1996 § 1412(b)(6) to set a standard less stringent than what it had determined was technologically feasible for large systems. The Agency further asserted that 10 μg/L "maximizes health risk reduction benefits at a cost that is justified by the benefits" (p. 7023) and that $492–559 per household per year was affordable, depending on system size (Table I.G-3).

Interpreting the statutory language consistent with the economic feasibility principle, benefits must exceed costs for the smallest water system subject to Federal regulation. Table 0-6 summarizes for four alternative MCLs USEPA's risk estimates under two alternative exposure scenarios; provides present value estimates of cancer risk reductions at the then applicable VSL ($6.1 million); and reports annualized risk-reduction benefits discounted over 35 years at 3% and 7%. Table 0-7 summarizes USEPA estimates of average treatment cost per household by system size. Cost and benefit estimates reported in USEPA (2000e) are not in comparable units, as benefits must be adjusted for household size. This is done in Table 0-8 (for the "lower bound" exposure scenario) and Table 0-9 (for the "upper bound" exposure scenario) for household sizes of 3 and 5.[4]

Table 0-10 shows the smallest-size community water system for which USEPA's 10 μg/L MCL is economically feasible and (in parentheses) annualized net benefits per household. In addition to household size, whether benefits exceed costs depends on the discount rate and exposure scenario. The sensitivity of net benefits to these factors indicates that considerably

[4] For household sizes smaller than 3, net benefits per household are negative for all system sizes and all four MCLs the Agency considered.

more effort should be devoted to developing objective risk estimates rather than relying on historical default assumptions and policy-driven risk models, and conducting comprehensive uncertainty analysis (Office of Management and Budget 2003). Complicating matters further, Hilkert Colby et al. (2010) present substantial empirical evidence that 10 μg/L also is not *technologically* feasible for small systems; 145 (mostly small) systems in California were out of compliance in January 2009, three years after the effective date.

Where USEPA's estimated net benefits are positive at 10 μg/L, they also are small. Annualized net benefits per household range from $0.52 to $6.05 per household in the "lower bound" exposure scenario and $18.81 to $31.92 in the "upper bound" exposure scenario. These estimates do not account for uncertainty in the hazard assessment, which if taken into account would render all net benefit calculations negative (Burnett and Hahn 2001b, a). Other analysts have reported much larger compliance cost estimates (Frey et al. 1998; Frey et al. 2000; Frost et al. 2002; Raucher and Cromwell 2004; Hilkert Colby et al. 2010; Gingerich et al. 2017), which further suggests that net benefits may be less than estimated by USEPA.

The arsenic rulemaking established 10 μg/L as the MCL for all systems, but for all systems serving fewer than 1 million persons it was not economically feasible. Thus, if USEPA had set the MCL at 10 μg/L based on the economic feasibility principle, all systems serving fewer than 1 million persons would have been exempt. The households they serve would have not realized the risk-reduction benefits in Table 0-6 but avoided the costs shown in Table 0-7, and thus been better off by the amounts shown in Table 0-11: $19.14 to $325.44 per household per year (depending on system size) and $126 million per year in the aggregate. These savings would have been partially offset by risk-reduction benefits if economically feasible technology existed to enable systems serving fewer than 1 million persons to achieve standards less stringent

than 10 μg/L and these technologies were voluntarily adopted by system managers. Setting the arsenic MCL at 20 μg/L instead of 10 μg/L would have reduced welfare losses by $7.3–$55 million.

Unlike post-1996 SDWA regulations generally, there is a substantial nongovernmental literature on the costs of arsenic treatment. Almost all of these studies indicate higher central tendency cost estimates and much greater variability. For example, in a study of California systems, Hilkert Colby et al. (2010) found capital costs ranging from $2–115,033 per design gpm; O&M costs ranging from $0.16–89.00 per 1,000 gallons; 22% of systems with costs exceeding the USEPA affordability threshold for a new regulation; and 15% of systems with costs exceeding the USEPA affordability threshold for drinking water. To the extent that nongovernmental studies are more accurate predictors of actual cost than USEPA's economic analyses, the economic feasibility of the arsenic MCL is less likely.

Table 7-6: Arsenic NPDWR: USEPA-estimated Annual Costs and Monetized Annual Cancer-prevention Benefits

Level (μg/L)	Annualized Cost ($M) ($1999, 7%)	Annual Bladder Cancer Benefits	Annual Lung Cancer Benefits	Total Annual Benefits ($M)	Net Annual Benefits ($M)
3	$792.1	$58.2–$156.4	$155.6–$334.5	$213.8–$490.0	($578.3)–($302.1)
5	471.7	$52.0–$113.3	$139.1–$242.3	$191.1–$355.6	($280.6)–($116.1)
10	205.6	$38.0–$ 63.0	$101.5–$134.7	$139.6–$197.1	($ 66.0)–($ 8.5)
20	76.5	$20.1–$ 21.5	$46.1–$ 53.8	$ 66.2–$ 75.3	($ 10.3)–($ 1.2)
Source: USEPA (2000e).					

Table 0-6: Arsenic NPDWR: USEPA-estimated Value of per Capita Cancer Risk Reduction by System Size and MCL

MCL (µg/L)	Risk for Mean Exposed Population Risk	PV Per Capita Risk Reduction	Annualized Value of Per Capita Risk Reduction, 35 years	
			r = 3%	*r* = 7%
"Lower Bound" Exposure Scenario				
3	1.10E-4	$67	$3.12	$0.24
5	2.70E-4	$165	$7.67	$0.59
10	6.30E-4	$384	$17.89	$1.38
20	1.10E-4	$671	$31.23	$2.41
"Upper Bound" Exposure Scenario				
3	1.25E-4	$763	$35.49	$2.74
5	2.02E-4	$1,232	$57.35	$4.43
10	2.99E-4	$1,824	$84.88	$6.56
20	3.85E-4	$2,349	$109.30	$8.44

Source: USEPA (2000e). VSL = $6.1 million. "Lower Bound" and "Upper Bound" exposure scenarios as described on p. 5-13.

Table 0-7: Arsenic NPDWR: USEPA-estimated Average Annual Household Cost by System Size and MCL

System Size	MCL (µg/L)			
	3	5	10	20
< 100	$317.00	$318.26	$326.82	$351.15
101-500	166.91	164.02	162.50	166.72
501-1,000	74.81	73.11	70.72	68.24
1,001-3,300	63.76	61.94	58.24	54.36
3,301-10,000	42.84	40.18	37.71	34.63
10,001-50,000	38.40	36.07	32.37	29.05
50,001-100,000	31.63	29.45	24.81	22.63
100,001-1,000,000	24.29	23.34	20.52	19.26
> 1,000,000	7.41	2.79	0.86	0.15
Source: USEPA (2000e).				

Table 0-8: Arsenic NPDWR: USEPA-estimated Annualized Net Benefit per Household of "Lower Bound" Cancer Risk Reduction by System Size for Four Alternative Arsenic MCLs and Two Household Sizes, 7% Discount Rate

System Size	MCL (µg/L) 3	5	10	20
Household Size = 3				
<100	($316.28)	($316.48)	($322.68)	($343.91)
101-500	($166.19)	($162.24)	($158.36)	($159.48)
501-1,000	($74.09)	($71.33)	($66.58)	($61.00)
1,001-3,300	($63.04)	($60.16)	($54.10)	($47.12)
3,301-10,000	($42.12)	($38.40)	($33.57)	($27.39)
10,001-50,000	($37.68)	($34.29)	($28.23)	($21.81)
50,001-100,000	($30.91)	($27.67)	($20.67)	($15.39)
100,001-1,000,000	($23.57)	($21.56)	($16.38)	($12.02)
> 1,000,000	($6.69)	($1.01)	$3.28	$7.09
Household Size = 5				
<100	($315.79)	($315.30)	($319.91)	($339.09)
101-500	($165.70)	($161.06)	($155.59)	($154.66)
501-1,000	($73.60)	($70.15)	($63.81)	($56.18)
1,001-3,300	($62.55)	($58.98)	($51.33)	($42.30)
3,301-10,000	($41.63)	($37.22)	($30.80)	($22.57)
10,001-50,000	($37.19)	($33.11)	($25.46)	($16.99)
50,001-100,000	($30.42)	($26.49)	($17.90)	($10.57)
100,001-1,000,000	($23.08)	($20.38)	($13.61)	($7.20)
> 1,000,000	($6.20)	$0.17	$6.05	$11.91

Source: Derived from Table 0-6 and Table 0-7.Table 0-6 and Table 0-7.

Table 0-9: Arsenic NPDWR: USEPA-estimated Annualized Net Benefit per Household of "Upper Bound" Cancer Risk Reduction by System Size for Four Alternative Arsenic MCLs and Two Household Sizes, 7% Discount Rate

System Size	MCL (µg/L)			
	3	5	10	20
Household Size = 3				
<100	($307.63)	($295.26)	($273.16)	($311.12)
101-500	($157.54)	($141.02)	($108.84)	($126.69)
501-1,000	($65.44)	($50.11)	($17.06)	($28.21)
1,001-3,300	($54.39)	($38.94)	($4.58)	($14.33)
3,301-10,000	($33.47)	($17.18)	$15.95	$5.40
10,001-50,000	($29.03)	($13.07)	$21.29	$10.98
50,001-100,000	($22.26)	($6.45)	$28.85	$17.40
100,001-1,000,000	($14.92)	($0.34)	$33.14	$20.77
> 1,000,000	$1.96	$20.21	$52.80	$39.88
Household Size = 5				
<100	($301.39)	($279.93)	($237.39)	($195.01)
101-500	($151.30)	($125.69)	($73.07)	($10.58)
501-1,000	($59.20)	($34.78)	$18.71	$87.90
1,001-3,300	($48.15)	($23.61)	$31.19	$101.78
3,301-10,000	($27.23)	($1.85)	$51.72	$121.51
10,001-50,000	($22.79)	$2.26	$57.06	$127.09
50,001-100,000	($16.02)	$8.88	$64.62	$133.51
100,001-1,000,000	($8.68)	$14.99	$68.91	$136.88
> 1,000,000	$8.20	$35.54	$88.57	$155.99
Source: Derived from Table 0-6 and Table 0-7.Table 0-6 and Table 0-7.				

Table 0-10: Arsenic NDPWR: Smallest Community Water System and USEPA-estimated Annualized Household Net Benefit by Household Size for which 10 µg/L is Economically Feasible

Discount Rate	**Risk Estimate**	
	"Lower Bound"	**"Upper Bound"**
3%		
Household Size = 3	3,301–10,000 $15.95	101–500 $92.15
Household Size = 5	501–1,000 $18.71	< 100 $97.60
7%		
Household Size = 3	>1 million $3.28	>1 million $18.81
Household Size = 5	>1 million $6.05	10,001–50,000 $0.41
Source: Derived from USEPA (2000e).		

Table 0-11: Arsenic NPDWR: Savings per Household and Aggregate Savings from an Economic Feasibility Rule Based on USEPA-estimated Benefits and Costs

System Size	MCL (µg/L)			
	3	5	10	20
Savings/Household Served by Systems Expected to Treat ($/Yr)				
<100	$316.76	$317.67	$325.44	$348.74
101-500	$166.67	$163.43	$161.12	$164.31
501-1,000	$74.57	$72.52	$69.34	$65.83
1,001-3,300	$63.52	$61.35	$56.86	$51.95
3,301-10,000	$42.60	$39.59	$36.33	$32.22
10,001-50,000	$38.16	$35.48	$30.99	$26.64
50,001-100,000	$31.39	$28.86	$23.43	$20.22
100,001-1,000,000	$24.05	$22.75	$19.14	$16.85
> 1,000,000	$7.17	$2.20	$0.00	$0.00
Savings/All Households Served by Systems Expected to Treat ($M/Yr)				
<100	$31.5	$18.7	$8.6	$3.6
101-500	$61.3	$37.3	$16.8	$6.6
501-1,000	$26.9	$15.9	$7.1	$2.7
1,001-3,300	$63.7	$38.2	$16.4	$6.1
3,301-10,000	$69.0	$40.4	$17.3	$6.2
10,001-50,000	$123.2	$73.7	$30.9	$10.8
50,001-100,000	$45.6	$26.1	$11.0	$3.8
100,001-1,000,000	$72.5	$44.1	$17.9	$6.1
> 1,000,000	$0.0	$0.0	$0.0	$0.0
Total Savings	**$493.8**	**$294.4**	**$126.0**	**$46.0**

Source: Derived from Table 0-8 and Table 0-9.

1.b.3. Lead and Copper: Short-Term Regulatory Revisions and Clarifications

In 2007, USEPA made seven changes in its existing NPWDR for lead and copper (USEPA 2007b). The Agency described the rule's purpose as "to protect populations from exposure to lead in drinking water to reduce potential health risks associated with lead" (USEPA 2007a). No benefits are quantified, however, so the economic feasibility of none of the seven provisions can be evaluated.

c. Miscellaneous Standards

1.c.1. Drinking Water Regulations for Aircraft Public Water Systems

In 2009, USEPA promulgated a final rule setting standards for drinking water in scheduled and charter passenger aircraft that serve on average at least 25 persons daily at least 60 days per year (USEPA 2009a).[5] USEPA obtained data indicating that about 4% of aircraft lavatory water samples tested positive for coliform (Table III-2). The Agency considered four options in its RIA but did not examine the no-action alternative (USEPA 2009b). No benefits were estimated, so the effects of having applied the economic feasibility principle cannot be characterized.

1.c.2. Revisions to the Total Coliform Rule

In 2013, USEPA promulgated a Revised Total Coliform Rule (RTCR) asserting that it provided "a meaningful opportunity for greater public health protection beyond the 1989 TCR" (USEPA 2013, p. 10270 [citing SDWA 1996 § (b)(1)(A)(iii)]). The rule required all CWSs and

[5] "[I]f an aircraft has a sink in the lavatory, then the water provided to that sink must be suitable for human consumption" (p. 53591)

NCWSs "vulnerable to microbial contamination to identify and fix problems, [and] establish[ed] criteria for systems to qualify for and stay on reduced monitoring, thereby providing incentives for improved water system operation" (p. 10270). USEPA estimated 155,000 public water systems serving 310 million individuals were covered (p. 10271). The Agency determined that the benefits of the rule justified the costs (p. 10335), so this rule is potentially susceptible to economic feasibility analysis.

The reported number and rate of positive total coliform and *E. coli* tests was described as "an indicator of baseline water," and ranged from a low of 0.00% (8 system type/size combinations) to a high of 0.46% (TNCWSs serving 101-500 persons) (USEPA 2013, p. 10308). These data were used to populate a model calculating MCL violations and triggers for regulatory requirements. A causal nexus between differences in violation frequency within these ranges and human health risk was asserted but not substantiated.

Three regulatory options were examined: the no-action alternative, the final rule as promulgated, and a more stringent "Alternative" option that would have required more frequent sampling. Though USEPA stated that the rule was cost-effective, it did not quantify social benefits (pp. 10308, 10319-10320). The Agency estimated expenditures for compliance (not opportunity costs) by system type and size. Estimated annualized compliance expenditures for the rule (and the more stringent Alternative) were $200 million ($216 million) at 3%, and $193 million ($210 million) at 7% (p. 10321 [Exhibit VI-15]).

Outcomes (e.g., health risk reduction) were assumed based on changes in inputs (e.g., monitoring frequency and corrective actions triggered by positive test results).[6] It is therefore

[6] USEPA (2013, p. 10309): "More frequent monitoring has the potential to decrease the risk of contamination in PWSs based on an enhanced ability to diagnose and mitigate system issues in a more timely fashion." Conversely, less frequent monitoring has the potential to increase risk. Real-time continuous sampling

unclear how the Agency determined that benefits justified costs. Finally, because USEPA did not include a less stringent alternative other than no-action, improvements in net social benefits from the adoption of the economic feasibility principle cannot be estimated.

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would mitigate the most risk possible based on sampling schedule; however, it would cost prohibitively more than the periodic sampling practiced under the 1989 TCR and included in the RTCR and the Alternative option."

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Rule Development Overview

Association of State Drinking Water Administrators
March 14, 2017

Lisa Christ
Office of Ground Water and Drinking Water

1

Thank you for the invitation to speak to you about our drinking water regulations.

In lieu of a formal presentation, this is produced as a handout for reference during and after the State-EPA Roundtable. It is being submitted to ASDWA on September 30, 2016

Rule Development:
Perchlorate

- In February, 2011 EPA published a final determination to regulate perchlorate in drinking water.
  - Perchlorate is of particular concern to infant and fetal nervous system development.
- EPA is performing analysis to:
  - Evaluate occurrence data.
  - Evaluate the feasibility of analytical methods and treatment technologies to remove perchlorate.
  - Examine the costs and benefits of potential standards.

2

Background -- Perchlorate is an inorganic chemical produced for use in rocket propellants, fireworks, road flares, and explosives. Perchlorate is also formed naturally in the environment, particularly in arid climates, and may be present as an impurity in hypochlorite solutions (bleach). In February 2011, Administrator Jackson announced EPA's decision to regulate perchlorate under the Safe Drinking Water Act (SDWA). EPA determined that perchlorate meets SDWA's three criteria for regulating a contaminant: 1) perchlorate may have adverse health effects because scientific research indicates that perchlorate can disrupt the thyroid's ability to produce the hormones needed for normal growth and development; 2) there is a substantial likelihood that perchlorate occurs with frequency at levels of health concern in public water systems because monitoring data show over four percent of public water systems have detected perchlorate; and 3) there is a meaningful opportunity for health risk reduction since between 5.1 and 16.6 million people may be provided with drinking water containing perchlorate.

SAB (EPA's Science Advisory Board) -- The SAB is authorized to: review the quality and relevance of the scientific and technical information being used by the EPA or proposed as the basis for Agency regulations; review EPA research programs and plans; provide science advice as requested by the EPA Administrator, and advise the Agency on broad scientific matters. Most (though not all) preliminary work of the SAB is done by subcommittees or panels focused on various environmental science topics. These groups are chaired by SAB members. Recommendations of subcommittees and panels are transmitted to the SAB for discussion and deliberation. Recommendations are forwarded to EPA only if the SAB determines that it is appropriate.

In accordance with SDWA, EPA requested comment from the Science Advisory Board (SAB) prior to proposing a Maximum Contaminant Level Goal (MCLG) and National Primary Drinking Water Regulation (NPDWR) for perchlorate. The SAB released its final report on May 29, 2013. The SAB recommended that EPA "derive a perchlorate MCLG that addresses sensitive life stages through physiologically-based pharmacokinetic/pharmacodynamic modeling" (PBPK).
The Agency has been collaborating with U.S. Food and Drug Administration and EPA Office of Research and Development scientists to address SAB recommendations regarding data collection and the review and development of PBPK/PD models to relate perchlorate exposure to biological effects "downstream" from the inhibition of iodide uptake.

Rule Development:

Perchlorate

Science Advisory Board Recommendations

- In 2011, EPA sought recommendations from the SAB on how to derive a Maximum Contaminant Level Goal (MCLG). The May, 2013 SAB report recommended the following:
  - "derive a perchlorate MCLG that addresses sensitive life stages through physiologically-based pharmacokinetic/pharmacodynamic modeling (PBPK)."
  - "utilize an MOA framework for developing the MCLG that links the steps in the proposed mechanism leading from perchlorate exposure through iodide uptake inhibition to thyroid hormone changes and finally neurodevelopmental impacts."
  - ". . . [t]his data-driven approach represents a more rigorous way to address differences in biology and exposure between adults and sensitive life stages than is possible with the default approach for deriving an MCLG."
- To address the SAB recommendations, EPA and FDA scientists have worked collaboratively since 2013 to develop a model to inform the derivation of a Maximum Contaminant Level Goal (MCLG) for perchlorate

Rule Development:

Perchlorate

- EPA is undertaking expert peer review of the BBDR model and approaches for deriving a perchlorate MCLG.
  - An eight member peer review panel met in January to discuss and evaluate the BBDR model and model report.
- Following completion and review of the recommendations from the BBDR Model peer review, EPA will undertake a subsequent peer review of methodologies to derive an MCLG for perchlorate.
- For the peer review of the MCLG report, the Agency will publish a Federal Register Notice to solicit public comment on:
  - A list of candidate peer reviewers;
  - The peer review charge questions; and
  - The MCLG approaches report
- EPA plans to hold the meeting this fall.

Rule Development:

Reduction of Lead in Drinking Water

- The RLDWA amended § 1417 of the SDWA regarding the prohibition on use and introduction into commerce of lead pipes, fittings, fixtures, solder and flux.
- The effective date of the Act was January 4, 2014.
- EPA published a summary of the RLDWA requirements and answers to some frequently asked questions related to the RLDWA to assist manufacturers, retailers, plumbers and consumers in understanding the changes to the law (2013)
- The above summary and other information is available at:

https://www.epa.gov/dwstandardsregulations/use-lead-free-pipes-fittings-fixtures-solder-and-flux-drinking-water

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In anticipation of these changes taking effect, EPA provided a summary of the requirements of the lead ban provisions in Section 1417 and some answers to frequently asked questions related to the amendments to assist manufacturers, retailers, plumbers, and consumers in understanding the changes to the law.

This rulemaking seeks to make conforming changes to EPA's existing regulations based on the RLDWA and potentially create new requirements, as necessary, to make demonstrating compliance more straightforward. The name of the rule is the following: "Regulations Implementing Section 1417 of the Safe Drinking Water Act: Prohibition on Use of Lead Pipes, Solder, and Flux".

Rule Development:

Reduction of Lead in Drinking Water

- EPA proposed regulations for the lead free requirements on January 17, 2017.
- The proposal included:
  - Codifying the change in definition of "lead free" and the calculation methodology
  - Labeling requirements for potable use products & certain products that are "used exclusively for non potable services"
  - Product certification requirements: third party for large firms and third party or self for small firms
  - Compliance information authority for information from manufacturers, retailers, etc
  - Codifying state enforcement requirement for the use prohibition
- EPA has been asked to extend the comment period an additional 30 days (current date is April 17, 2017)

Rule Development:

Revisions to the Lead and Copper Rule

Background

- EPA under the Safe Drinking Water Act (SDWA) sets public health goals and enforceable standards for drinking water quality
- Lead and Copper: National Primary Drinking Water Regulation (NPDWR) initially promulgated June 7, 1991
- The goal of the LCR is to:
  - Protect public health by minimizing lead and copper levels in drinking water, primarily by reducing water corrosivity
- The rule applies to All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs)
- The LCR addresses corrosion and leaching of lead and copper from service lines and household plumbing in to drinking water

Rule Development:

Revisions to the Lead and Copper Rule

Background

- EPA conducted a national review of LCR implementation issues in 2004
  - collected and analyzed lead concentration data
  - carried out a review of implementation and monitoring at the state level
  - held four expert workshops to discuss elements of the regulations
- EPA released the ***Drinking Water Lead Reduction Plan (DWLRP)*** in March 2005
  - The plan outlined both short and long term goals for improving LCR implementation
- In 2007 EPA promulgated the Short-term Revisions to the LCR
  - The rule enhanced monitoring, treatment, lead service line replacement, public education, and customer awareness
- EPA is currently working on the Long-term Revisions to the LCR
  - The areas of the rule requiring revision were identified in the DWLRP and the 2007 Rule

Rule Development:

Revisions to the Lead and Copper Rule

- EPA requested the NDWAC form a working group to provide stakeholder input on several key rule revision issues
  - The 16 member WG was comprised of a diverse group of impacted stakeholders – states, utilities, environmental, public health groups/organizations and public interest/citizen group representatives.
- In December 2015 the NDWAC provided the following recommendations:
  - Proactive Lead Service Line Replacement programs
  - More robust public education requirements for lead and LSLs
  - Strengthening Corrosion Control Treatment requirements
  - Modify monitoring requirements to provide for consumer requested tap samples for lead
  - Tailor water quality parameters for each system and increase frequency of monitoring
  - Establish a health based household action level
  - Separate copper requirements focused on water corrosive to copper
  - Establish appropriate compliance and enforcement mechanisms

9

Background -- Infants and children who drink water containing lead could experience delays in their physical or mental development. Children could show deficits in attention span and learning abilities. Adults who drink water containing lead well in excess of the action level for many years could develop kidney problems or high blood pressure. People who drink water containing high levels of copper experience transient gastrointestinal distress from exposures and potentially liver or kidney damage from chronic exposures. EPA promulgated the Lead and Copper Rule in 1991 to minimize the corrosion of these contaminants into drinking water. In 2004, EPA began a review of LCR implementation to determine if there was a national problem related to elevated levels of lead in drinking water and opportunities to improve and clarify specific areas of the rule and our guidance materials. EPA released a Drinking Water Lead Reduction Plan in March 2005. This plan outlined short-term goals for improving implementation of the LCR and identified other "long-term" issues that would require further research and data collection.

NDWAC (National Drinking Water Advisory Council) -- The Council, comprising members of the general public, state and local agencies, and private groups concerned with safe drinking water, advises the EPA Administrator on everything relating to drinking water for the Agency.

NDWAC working groups – These groups consist of approximately 20 members with a variety of viewpoints. These working groups make recommendations to the full Council, which in turn advise EPA on individual regulations, guidance, and policy matters. All NDWAC working group meetings and full NDWAC meetings are open to the public.

Rule Development:

Revisions to the Lead and Copper Rule

- October 2016, EPA released a LCR Revisions White Paper
- The white paper provides examples of regulatory options to improve the existing rule and highlights key challenges, opportunities, and analytical issues presented by these options.
  - Lead service line replacement
  - Improved optimal corrosion control treatment
  - Health based benchmark for lead
  - Potential role for point of use filters
  - Clarify and strengthen sampling requirements
  - Increased transparency and information sharing
  - Public Education
  - Copper
  - Relationship with broader lead issues
- Our current expectation is that revisions to the rule will be proposed in 2017.

Rule Development:

Revisions to the Lead and Copper Rule

- On January 19, 2017, EPA initiated a peer review of draft scientific modeling approaches to inform EPA's evaluation of potential health-based benchmarks for lead in drinking water.
  - FRN sought nominations for peer reviewers (30 days) and public comment on draft report and charge questions (45 days)
- EPA will announce the peer reviewers and meeting logistics 30 days prior to the peer review meeting [~ mid summer]
- EPA will not be asking the peer reviewers to select a specific value or to provide input on the role for a health-based benchmark in proposed LCR revisions.
- EPA will consider the specific role for a health-based benchmark in the proposed revisions to the LCR after the peer review of the modeling effort has been completed.

Message

From: Burneson, Eric [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=2CACB9A8D49F49AF80531E9E2CCB9018-EBURNESO]
Sent: 1/4/2018 5:08:48 PM
To: Alexandra Dapolito Dunn [adunn@ecos.org]; lpiper@ecos.org
CC: Hanson, Andrew [Hanson.Andrew@epa.gov]; Christ, Lisa [Christ.Lisa@epa.gov]
Subject: U.S. EPA UMRA/Federalism Consultation for the Lead and Copper in Drinking Water Rule
Attachments: LCR Federalism Consultation Letter.signed.12 14 17.pdf

Alex and Layne: Below is the information about Monday's Federalism Consultation on the Lead and Copper Rule. I am sorry to learn you did not receive the original invitation to participate in this meeting. We hope that an ECOS representative can participate in the meeting on Monday. Please contact Andrew Hanson to confirm who will be participating from ECOS.
Thanks for your interest in this important topic.

Eric Burneson, P.E.
Director of Standards and Risk Management
Office of Ground Water and Drinking Water
U.S. Environmental Protection Agency
202 564 5250

Dear State and Local Colleagues:

Protecting children's health is one of EPA's highest priorities and the agency continues to engage with stakeholders and assess recommendations from leading experts on ways to improve the health protections provided by the Lead and Copper Rule. A next step is for EPA to engage with state and local officials to allow for meaningful and timely input on potential rule revisions We therefore are pleased to invite you to participate in our UMRA/Federalism Consultation meeting on January 8, 2018. The input that you and your members provide will help ensure that any potential revisions to the lead and copper rule address the concerns and issues of our state and local partners. Thank you for your continued engagement with EPA as we all work together to protect human health by assuring safe drinking water. Please see the attached invitation letter for more information on this consultation and the rulemaking.

SAVE THE DATE

What: **Unfunded Mandates Reform Act/Federalism Consultation to discuss Potential Revisions to the Lead and Copper in Drinking Water Rule**

When: **Monday, January 8, 2018**
2:00 – 4:00 p.m. EST

Where: **William Jefferson Clinton Building – EAST**
Room 2123
1201 Constitution Avenue, NW, Washington, DC

RSVP to Hanson.Andrew@epa.gov if you plan to attend.

Best Regards and Happy Holidays,

Jack Bowles
Director of State & Local Relations
U.S. Environmental Protection Agency
202-564-3657 (office) | 2 Ex. 6 Personal Privacy (PP) (mobile)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 1 4 2017

OFFICE OF WATER

Dear Intergovernmental Association Colleague:

The purpose of this letter is to seek your input on the U.S. Environmental Protection Agency's forthcoming proposed regulatory revisions to the Lead and Copper Rule. The EPA is evaluating potential revisions to the LCR to improve public health protection while ensuring effective implementation. The LCR applies to community water systems and non-transient non-community water systems as defined by the Safe Drinking Water Act. Revisions to the LCR would impact owners and operators of public water systems that must comply with the LCR and primacy agencies that enforce drinking water regulations in their jurisdiction. To that end, we would like to invite you to a meeting to be held at the EPA Headquarters on January 8, 2018, 2:00 p.m. – 4:00 p.m., in room 2123 of the EPA East Building, 1201 Constitution Ave., NW, Washington, DC 20004.

Consultation is requested pursuant to the terms of Executive Order 13132, entitled "Federalism," which directs federal agencies to consult with elected state and local government officials, or their representative national organizations, when developing regulations and policies that impose substantial compliance costs on state and local governments. Options being considered for the proposed rule may also meet consultation requirements of the Unfunded Mandates Reform Act. Thus, the agency has elected to engage the UMRA stakeholders in the same consultation as there are many overlapping interests between the groups, and a discussion of the proposed rule can be more effectively communicated in a joint meeting.

The agency established the LCR in 1991 to reduce exposure to lead through drinking water. The primary contribution of lead and copper to drinking water is corrosion from service lines and in-home plumbing materials. The LCR requires water systems to implement a treatment technique (corrosion control) that is designed to reduce lead and copper in tap water to the extent feasible. The corrosion control treatment makes the water less corrosive to lead and copper in plumbing materials.

The LCR established a non-enforceable maximum contaminant level goal of zero for lead. The MCLG for lead is zero because there is no level of exposure to lead that is without risk. As required by the SDWA, the agency developed the LCR to reduce concentrations of lead and copper in drinking water to levels that are as close as feasible to this MCLG.

The LCR applies to all public water systems except those that do not regularly serve at least 25 of the same people at least 6 months of the year. The LCR requires water systems to sample households served by their system and requires systems to take actions to reduce exposure to lead and copper from drinking water. The actions triggered by the LCR monitoring results may include treatment to control

lead and copper corrosion, the replacement of lead service lines, and the dissemination of educational materials to customers.

The agency is currently in the process of evaluating potential regulatory changes to the existing LCR in the areas of tap sampling, corrosion control treatment, transparency and public education, full lead service line replacement and copper. The EPA is requesting your input on options for the proposed regulatory revisions. Additional information can be found at: https://www.epa.gov/dwreginfo/lead-and-copper-rule.

Pursuant to this consultation process, the agency is contacting the National Governors' Association, the National Conference of State Legislatures, the Council of State Governments, the National League of Cities, the U.S. Conference of Mayors, the National Association of Counties, the International City/County Management Association, the National Association of Towns and Townships, the County Executives of America, and the Environmental Council of States to request their input on this rulemaking. Additionally, the agency is inviting the Association of State Drinking Water Administrators, the Association of Metropolitan Water Agencies, the National Rural Water Association, the American Water Works Association, the American Public Works Association, the National School Board Association, the American Association of School Administrators, and the Western Governors' Association to participate in this meeting.

The EPA is requesting your attendance at this meeting to obtain your input on the options under consideration. At the meeting, the agency will present background information on the rulemaking and will answer questions you may have. You will have the opportunity to provide input to the agency during the meeting and may provide written input to the EPA within 60 days after the meeting. Although this initial, in-person briefing is for intergovernmental association staff only, there will be an opportunity for associations to schedule briefings for their memberships following this initial briefing.

Please let us know if you will be able to attend by contacting Andrew Hanson in EPA's Office of Congressional and Intergovernmental Relations at hanson.andrew@epa.gov or 202-564-3664.

If you have questions regarding the rule, you may contact Iliriana Mushkolaj of the Office of Groundwater and Drinking Water at Mushkolaj.Iliriana@epa.gov or 202-564-6877.

Sincerely,

Peter Grevatt, Director
Office of Ground Water and Drinking Water

Message

From: Robinson, Matt M. [Robinson.MattM@epa.gov]
Sent: 10/29/2014 8:43:57 PM
To: Gail Bingham [gbingham@resolv.org]; Chris Wiant (cwiant@caringforcolorado.org) [cwiant@caringforcolorado.org]; Christina Baker [christina.baker@ded.mo.gov]; Derrick Dennis [Derrick.Dennis@DOH.WA.GOV]; Gary.Burlingame@phila.gov; Hector F. Gonzalez [hgonzalez@ci.laredo.tx.us]; John Sasur Ex. 6 Personal Privacy (PP) June.swallow@health.ri.gov; Leon Bethune (lbethune@bphc.org) [lbethune@bphc.org]; Lynn Thorp [lthorp@cleanwater.org]; Marilyn Christian (mchristian@hcphes.org) [mchristian@hcphes.org]; Matthew Corson (matthew.corson@amwater.com) [matthew.corson@amwater.com]; Nse Obot Witherspoon (nobot@cehn.org) [nobot@cehn.org]; Robert Steidel (Robert.Steidel@richmondgov.com) [Robert.Steidel@richmondgov.com]; Stephen Estes-Smargiassi (smargias@mwra.com) [smargias@mwra.com]; Tom Neltner (tneltner@gmail.com) [tneltner@gmail.com]; Yanna Lambrinidou Ex. 6 Personal Privacy (PP)
CC: Anne Jaffe Murray [anne.jaffemurray@cadmusgroup.com]; Christine Maloni Hoover (choover@paoca.org) [choover@paoca.org]; Darrell Osterhoudt (dosterhoudt@asdwa.org) [dosterhoudt@asdwa.org]; Ellis, Jerry [Ellis.Jerry@epa.gov]; Helm, Erik [Helm.Erik@epa.gov]; Jim Taft [jtaft@asdwa.org]; Justin Snair (jsnair@naccho.org) [jsnair@naccho.org]; Christ, Lisa [Christ.Lisa@epa.gov]; Michael Deane (michael@nawc.com) [michael@nawc.com]; Mike Keegan (keegan@bookcase.com) [keegan@bookcase.com]; Paul Schwartz [paul1959421@yahoo.com]; Petra Smeltzer (petra@nawc.com) [petra@nawc.com]; Scott Biernat (biernat@amwa.net) [biernat@amwa.net]; svia@awwa.org; Susan Satter (ssatter@atg.state.il.us) [ssatter@atg.state.il.us]; Thomas Plant (TPlant@bphc.org) [TPlant@bphc.org]
Subject: NDWAC LCR Work Group- Sample Site Selection, May Meeting Summary
Attachments: Final NDWAC LCR Sample Site Selection Meeting Summary_May 2014.pdf

All,
Attached is the final May, Sample Site Selection Summary. This is the version, with the working group's comments incorporated, that was approved at the September meeting.

Best,

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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.

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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]:

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[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/.

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- 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

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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.

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(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?

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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.

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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.

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[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.

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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

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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.

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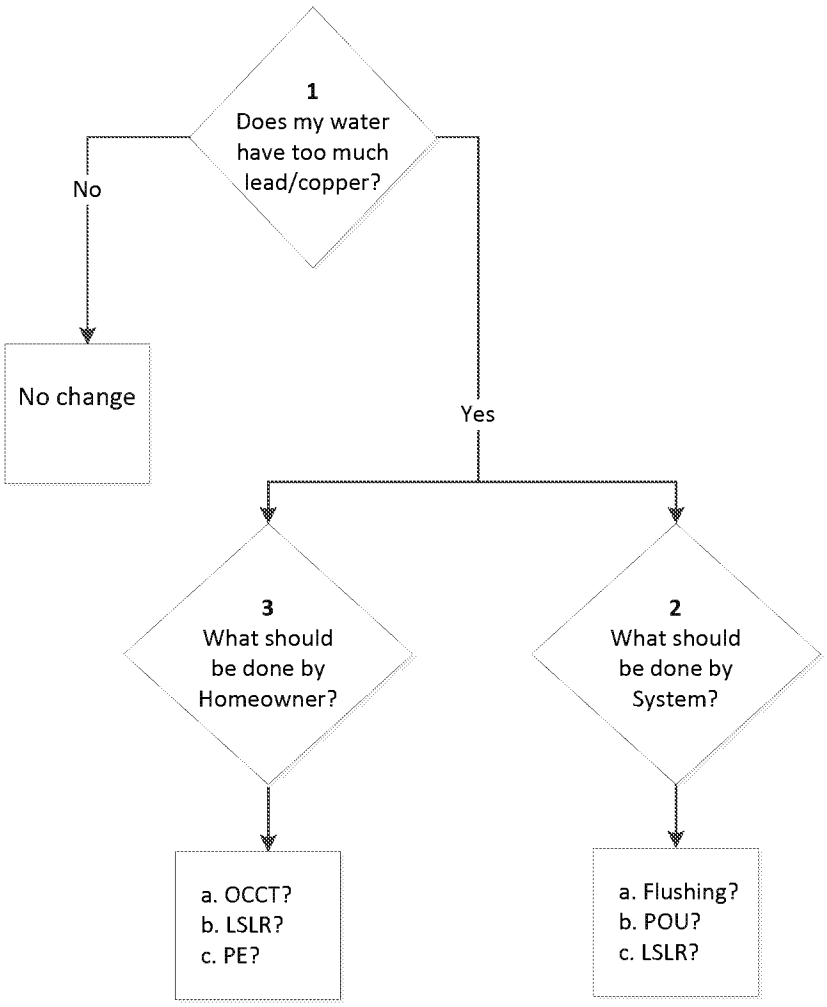
1. *"Does my water have too much lead/copper?" If "No", then no change. If "Yes", ask:*
2. *"What should be done by the system?" Possible answers include OCCT, LSLR, PE.*
3. *"What can be done by the homeowner?" Possible answers include flushing, point-of-use (POU) devices, and LSLR.*



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

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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.

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- 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

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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

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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

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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.

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- 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.

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- 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

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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.

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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

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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.

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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.

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- 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:

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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

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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).

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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

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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.

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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?

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- 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.*)

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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?

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- 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

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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
Thomas	Neltner	Natural Resources Defense Council
Darrell	Osterhoudt	Association of State Drinking Water Administrators
Chris	Raines	EPA
Regu	Regunathan	Water Quality Association
George	Rizzo	EPA
Alan	Roberson	American Water Works Association
Jason	Rubinstein*	EPA
Stephanie	Salmon	Plumbing Manufacturers International
John	Sasur, Jr.	Three Rivers Fire District
Mike	Schock	EPA

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First Name	Last Name	Affiliation
Paul	Schwartz	Water Alliance
Nicole	Shao	EPA
Roy	Simon	EPA
Lameka	Smith*	EPA
Francine	St. Denis	EPA
Robert	Steidel	City of Richmond Virginia
June	Swallow	Rhode Island Department of Health
Lynn	Thorp	Clean Water Action
Steve	Via	American Water Works Association
Pat	Ware*	Bloomberg, Bureau of National Affairs
Robert	Weed	Copper Development Association
Chris	Wiant	Caring for Colorado
Daniel	Wilson	North Carolina Rural Water Association
Nse Obot	Witherspoon	Children's Environmental Health Network

*Attended May 29, 2014 session only.

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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.

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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.

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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
≤ 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

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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)

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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);

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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

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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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Message

From: Steve Via [SVia@awwa.org]
Sent: 3/19/2013 12:50:25 PM
To: Kempic, Jeffrey [Kempic.Jeffrey@epa.gov]; Christ, Lisa [Christ.Lisa@epa.gov]
Subject: LCR

In case you did not see today's Inside EPA coverage of Peter Grevatt's talk. Thanks for getting word out to community.

Steve Via
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Daily News

EPA Delays Key Drinking Water Rules Over Lingering Science Questions

Posted: March 18, 2013

EPA is delaying key drinking water policies, including its pending health goal for perchlorate and a determination whether to regulate hexavalent chromium (Cr6), until officials can resolve questions related to the contaminants' pathways and other scientific issues, according to Peter Grevatt, director of EPA's Office of Ground Water & Drinking Water.

Grevatt told the Association of Metropolitan Water Agencies (AMWA) at it annual water policy conference in Washington, DC, March 18 that the agency is holding off on issuing its proposed maximum contaminant level goal (MCLG) for perchlorate until it has time to fully digest the final recommendations of its Science Advisory Board (SAB), which is slated to review the latest draft of its perchlorate panel's report on March 29.

He said that both former EPA Administrator Lisa Jackson and current acting Administrator Bob Perciasepe have made it "very clear" to the agency's drinking water office that "our number one priority on perchlorate is to get the science right."

He added that EPA's efforts on Cr6 are "like perchlorate in that we're still developing the science" and the agency is trying to ensure that any drinking water regulations -- which also form the basis of waste cleanup standards -- do not "get out in front" of the scientific analysis.

"There's a very important question on [Cr6] carcinogenicity when ingested; we need to wait until we have some clarity on that," he said. And he said the agency was also grappling with resolving scientific issues related to its novel plan to regulate up to 16 carcinogenic volatile organic compounds (VOCs) as a group.

The office has also struggled with updating its Lead and Copper Rule, though Grevatt said this is because of policy and economic concerns, not scientific issues.

His comments come amid concerns that the agency has been slow to exercise new authority to regulate drinking water contaminants that Congress provided in 1996 when it reauthorized the Safe Drinking Water Act (SDWA). For example, several congressional Democrats have raised concerns that the agency has not regulated any contaminants using the new authority.

But Jackson announced in February 2011 that EPA had determined that perchlorate, a chemical used in rocket fuel and found naturally in some soil, was eligible for regulation, reversing a Bush EPA decision and starting a two-year statutory clock under SDWA for the agency to publish its draft MCLG, the first time since the law was revised.

However, EPA has been struggling to assess perchlorate's risks and missed a Feb. 11 deadline to release the draft MCLG -- which will eventually form the basis for an enforceable drinking water standard, known as a maximum contaminant level (MCL).

Before EPA can release its draft MCLG, SAB must complete its report and submit it to the agency, and a panel to limit harms to small entities, which does not appear to have been scheduled.

But the SAB panel is recommending that EPA adopt a novel approach to setting the perchlorate MCLG, that complicates the agency's path because it steps away from the usual method of calculating an MCLG. Specifically, the SAB panel is recommending that EPA use a pharmacokinetic/pharmacodynamic (PBPK/PD) model rather for assessing risk rather than EPA's traditional algebraic formula. The approach is intended to better reflect the risk that perchlorate exposure presents to fetuses' and infants' proper development, as they are most susceptible to the potential adverse developmental effects of altered thyroid function.

Grevatt told the AMWA conference, however, that the SAB's final report, which the agency expects at the end of the month, will drive the schedule for moving forward on the MCLG because the agency is continuing to struggle with complex toxicity issues related to the effort. "We need to make sure we understand their recommendations," he said.

Regulating Cr6

The former head of EPA's children's office also indicated that the agency is awaiting additional science before moving ahead with a determination on whether to regulate Cr6.

While EPA has an MCL for total chromium of 100 parts per billion, which includes Cr6 and trivalent chromium, the agency has weighed whether to develop a stand-alone MCL for Cr6 following a controversial 2010 draft Integrated Risk Information System (IRIS) assessment labeling the metal a human carcinogen when ingested.

The draft stalled following a 2011 peer review where several of the panelists urged EPA to delay the assessment and await the results of ongoing industry-funded research intended to determine how Cr6 causes cancer when ingested.

The agency is also awaiting Cr6 monitoring data that drinking water utilities are slated to provide the agency as a result of its third unregulated contaminants monitoring rule, which officials have said will provide key exposure data.

In an interview, Grevatt said the drinking water office is also holding off on an SAB review of the agency's plan to regulate 16 carcinogenic VOCs in a group, though the board will eventual review a draft rule. "We're still working through some key issues on the approach," Grevatt told the AMWA meeting, saying the agency intends to build the rule on its IRIS assessments for the solvents trichlorethylene and perchloroethylene.

One rule the agency is grappling with for policy reasons is its forthcoming revisions to the Lead and Copper Rule, Grevatt said, because officials are seeking to solicit more stakeholder input on how to set partial line replacement requirements and how to address differing abilities of water utility customers to pay for such replacements.

"We're not at the right place in figuring out what to do -- there are some very tough issues we have to work through," he said.

Grevatt added that the agency is facing similar concerns as it works to implement the statutorily mandated revisions to lower lead content in drinking water pipes and plumbing fixtures which came about after Public Law 111-380 changed SDWA's definition of "lead-free" to a weighted average of no more than 0.25 percent lead content for pipes.

Grevatt said the agency has identified the need to "take a little pause" and asked AMWA for recommendations on the issues, particularly the line replacement requirements, adding "We need to make sure we get this right."

Drinking water utilities have urged EPA to maintain a "practical focus" on implementing the statutorily mandated revisions to lower lead content in drinking water pipes and plumbing fixtures, cautioning that the law's short compliance deadline means EPA should avoid creating a new lead-free "compliance paradigm" that could complicate the requirement.

Under the statutory changes, EPA is required to implement the new "lead-free" definition by Jan. 4, 2014, and is issuing an interim guidance by the end of the year that is intended to tackle questions on repairs, third party certifications and "what constitutes lead-free," Grevatt said.

Coliform Rule

Also during the AMWA conference, Grevatt touted EPA's Revised Total Coliform Rule, which was finalized Dec. 20, updating the agency's restrictions on pathogens in drinking water, as a model for effective stakeholder engagement. Under the new rule, there is no longer a monthly MCL violation for multiple total coliform detections. Instead, the revisions require systems that have an indication of coliform contamination in the distribution system to assess the problem and take corrective action that may reduce cases of illnesses and deaths due to potential fecal contamination and waterborne pathogen exposure.

Grevatt said that the rule should serve as an example of "how we want to engage in drinking water protection" because it was met with praise from both industry and environmental stakeholders as reducing sampling burdens while at the same time protecting public health. And Grevatt highlighted the agency's long-awaited guidance allowing electronic distribution of mandatory reports that drinking water utilities provide annually to customers, outlined in a Jan. 3 memo to EPA regional water division directors.

Acknowledging that some environmentalists have criticized the guidance as a rollback of public right-to-know law because it may make it more difficult for low-income customers without Internet access to gain information on the quality of their water, Grevatt said "I don't believe that's where drinking water utilities are at" in pushing for the flexibility.

Grevatt asked AMWA for assistance in promoting best practices to make sure that customers without Internet access still receive a paper delivery copy of the annual report, but also touted the memo as an example of innovative strategy for increasing access and reducing burdens. -- *Bridget DiCosmo* (bdicosmo@iwpnews.com This e-mail address is being protected from spambots. You need JavaScript enabled to view it)

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The Authoritative Resource on Safe Water (R)

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Message

From: June Swallow [June.Swallow@health.ri.gov]
Sent: 7/28/2015 8:30:36 PM
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Subject: Re: NDWAC LCRWG - Revised draft report (REPLY REQUESTED)
Attachments: NDWAC LCR Work Group ReportDRAFTFIVE 7 15 2015 track ch.docx

Gail, I was also on vacation and not able to download the report for review. Here are my comments...no show stoppers.

>>> Gail Bingham <gbingham@resolv.org> 7/23/2015 4:43 PM >>>
Greetings,

As promised – and with many thanks for everyone's contributions to these ideas over the past year – attached is the revised draft of the LCRWG's report to the NDWAC in both track changes and as a clean copy. The action item for you now is to let me know whether you agree that this reflects the agreements reached at the June meeting. I have checked relevant sections with a few members who were active in crafting the language, so hope and believe that you will find this draft an accurate reflection of what was agreed. Please call or email if you have any questions or concerns. ***Please reply by email (by August 10) if you agree.*** If you can't make the deadline, please let me know what would work for you.

Most of the edits are direct language from the meeting. I've also made non-substantive edits after the meeting. In addition, there are a few places where I made substantive changes after the meeting, generally for consistency with decisions made or to answer a question in a comment field from the last draft. I think these are straightforward, but I am noting the key below for transparency (page numbers are for the track changes version):

p. 5 – added a paragraph to the executive summary characterizing the group's discussion of costs (per the group's request at the meeting, but done after the meeting)

p.8 – moved two paragraphs about copper from the deleted "history" section to the regulatory background section (so the request at an earlier meeting isn't lost)

p.12 – revised the diagram to match the recommendations

p.14 – added main replacement to the examples in the paragraph about PLSLRs that was added at the meeting (per the group's discussion) but also changed the order of the examples from what had been handed out so that the conditional phrase "when a sufficiently high percentage of property owners participate" doesn't apply to main replacement. The logic was discussed at the meeting, i.e. avoiding having PWSs digging up each LSL

while replacing the main, disturbing it with the attendant increase in lead levels, but then leaving all of the LSLs in place and having to dig the street up again in the future. The requirement in the first sentence of that paragraph still applies that this only occurs after the efforts to get customers to agree to full LSLR recommended elsewhere in the report have been done.

p.33 – transition language is from the comment field in the earlier draft, with two sentences added at the end of the paragraph after the meeting to reflect the discussion

p.36 – inserted recommendations drafted at the meeting relating to how tap sampling will be used to assess the effectiveness of CCT, with the exception of the following:

- Added a phrase at the end of the first bullet ("and include which of the menu of sampling protocols referenced above was used") for consistency with that idea mentioned in a paragraph on the previous page.
- Combined the last three bullets into two (as directed at the meeting)

p.37 – modified the sample invalidation recommendations to be consistent with the customer-initiated tap sampling approach (to implement the comment field from the previous draft)

Section 4.0 – although not a substantive change, I reordered those recommendations into groups generally by who they are directed to (an idea after the meeting)

Thank you again for all your hard work. I look forward to hearing from you, Gail

Gail Bingham
RESOLVE
Ph: (202) 965-6200 | Cell: Ex. 6 Personal Privacy (PP)

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Report of the Lead and Copper Rule Working Group
To the National Drinking Water Advisory Council

FIFTH DRAFT

[NOTE: THIS DRAFT IS BASED ON THE LCRWG'S JUNE 24-25, 2015 MEETING AND WILL BE CIRCULATED TO THE WORKING GROUP FOR CONFIRMATION.]

JULY 2015

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Appendix A – Lead and Copper Working Group Members

Appendix B – Table 2

Figures

Figure 1 – Overview of Recommended Revised Lead and Copper Rule Framework

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Abbreviations

AL – Action Level
ALE – Action Level Exceedance
CCR – Consumer Confidence Report
CCT – Corrosion Control Treatment
DWLRP – Drinking Water Lead Reduction Plan
EPA – Environmental Protection Agency
LAL – Lead Action Level
LCR – Lead and Copper Rule
LCRWG – Lead and Copper Rule Working Group
LSL – Lead Service Line
LSLR – Lead Service Line Replacement
LTR LCR – Long Term Revisions to the Lead and Copper Rule
MCLG – Maximum Contaminant Level Goal
µg/L – Microgram per Liter
µg/dL – Microgram per deciliter
NDWAC – National Drinking Water Advisory Committee
OGWDW – Office of Ground Water and Drinking Water
OCCT – Optimum Corrosion Control Treatment
OWQP – Optimal Water Quality Parameter
PE – Public Education
pH – Negative log of hydrogen ion molar concentration
PLSLR – Partial Lead Service Line Replacement
POTW – Publicly owned treatment works
POU – Point-of-use treatment device
PWS – Public Water System
SAB – Science Advisory Board
SDWA – Safe Drinking Water Act
DWSRF – Drinking Water State Revolving Fund
TT – Treatment Technique
WQP – Water Quality Parameter

DRAFT

Report of the Lead and Copper Rule Working Group to the National Drinking Water Advisory Council

1. Executive Summary

The Lead and Copper Rule Working Group (LCRWG) of the National Drinking Water Advisory Council (NDWAC) has completed its deliberations on issues associated with long term revisions to the Lead and Copper Rule (LCR). This report includes the group's findings and recommendations.

This executive summary provides a brief overview of the report. Details of the findings and recommendations are provided in the body of the report. A list of the members of the working group can be found in Appendix A.

1.1. Charge

The charge to the LCRWG was to provide advice to the NDWAC as it develops recommendations for the U.S. Environmental Protection Agency (EPA) on targeted issues related to long term revisions to the Lead and Copper Rule under the Safe Drinking Water Act (SDWA).

1.2. Findings and Recommendations

The anticipated Long Term Revisions to the Lead and Copper Rule (LTR LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential.

The LCRWG took the following considerations, among others, into account in making recommendations for revisions to the LCR. A more detailed list of considerations is included in the full report.

~~First,~~ there is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for pregnant women, infants and young children and other vulnerable populations with both acute and chronic exposures. Effective elimination of lead materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility; public water systems (PWSs), consumers, building owners, public health officials and others each have important roles to play. The lack of resources to reduce the sources of exposure in some communities, however, also raises important questions of disparate impact and environmental justice. Thus, creative financing mechanisms will be needed.

The LCR should remain a treatment technique rule, but it can be improved based on the scientific knowledge that has emerged since the current LCR was promulgated. Corrosion control treatment is complicated, and will vary based on specific circumstances in each public water system. Thus, regular updates by EPA to guidance based on the latest science and the creation of a national clearinghouse of information both for the public and for PWSs is needed.

The LCRWG considered but did not quantify the cost implications of its recommendations. An important factor in the group's deliberations was the principle that PWS and state resources should be focused on actions that achieve the greatest positive health outcomes. Recognizing that lead service line (LSL) replacement programs will be costly in some locations, the LCRWG also encourages PWSs to incorporate

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anticipated costs into their capital investment program as appropriate to their situation, and urges states to include the costs of LSL replacement in their criteria for allocation of Drinking Water State Revolving Funds.

The LCRWG specifically recommends that EPA revise the LCR to:

- Require proactive lead service line (LSL) replacement programs, which set replacement goals, effectively engage customers in implementing those goals, and provide improved access to information about LSLs, in place of current requirements in which LSLs must be replaced only after a lead action level (AL) exceedance ~~and corrosion control treatment (CCT)~~;
- Establish~~es~~ more robust public education requirements for lead and LSLs, by updating the Consumer Confidence Report (CCR), adding targeted outreach to consumers with lead service lines and other vulnerable populations (pregnant women and families with infants and young children), and increasing the information available to the public;
- Strengthen CCT, retaining the current rule requirements to re-assess CCT if changes to source water or treatment are planned, adding a requirement to review updates to EPA guidance to determine if new scientific information warrants changes ;
- ~~s~~ Modify monitoring requirements to provide for consumer requested tap samples for lead and to~~s~~ utilize~~s~~ results of tap samples for lead to inform consumer action to reduce the risks in their homes, to inform the appropriate public health agency when results are above a designated household action level, and to assess the effectiveness of CCT~~.~~;
- tailor~~s~~ water quality parameters (WQPs) to the specific CCT plan for each system, and increase~~s~~ the frequency of WQP monitoring for process control;
- Establish a health-based, household action level that triggers a report to the consumer and to the applicable health agency for follow up;
- Separate the requirements for copper from those for lead and focus new requirements where water is corrosive to copper; and
- Establish appropriate compliance and enforcement mechanisms.

Although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other EPA offices; federal state and local agencies and other stakeholders. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

2. Considerations and Background Information

2.1. Considerations in Preparing this Report

The members of the LCRWG brought different perspectives and expertise to the preparation of this report. Although not all members agreed with each and every consideration listed below, the LCRWG took one another's perspectives into account and, thus, the following concepts collectively underlie the recommendations in this report. Additional detail is provided in the recommendations section below.

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- There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for pregnant women, infants and children with both acute and chronic exposures.
- Lead-bearing plumbing materials in contact with drinking water pose a risk at all times (not just when there is a lead action level (LAL) exceedance).
- Effective elimination of lead materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility. PWSs, consumers, building owners, public health officials and others each have important roles to play.
- The LTR LCR is an important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. However, additional action beyond the scope of the Safe Drinking Water Act is needed. Removing lead from drinking water systems also will require renewed commitment, cooperation and effort by government at all levels and by the general public. (See Section 5: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)
- Proactive action is needed to remove the sources of lead, with appropriate incentives both for PWSs and their customers needed to encourage such action.
- Successful implementation of the revised LCR can only take place in the context of a more holistic effort on lead in water issues involving stakeholders other than just EPA and water systems, and resources beyond those able to be brought to bear by water systems. Partnerships at all levels are essential. Recognizing that public agency budgets are tighter than ever, greater engagement by local health agencies, those funding housing programs, and those involved in permitting and construction is particularly important.
- Creative financing mechanisms also will be needed to achieve this goal for all individuals potentially exposed to lead, regardless of race, ethnicity or income. Leaving a lead service line in place because a low-income resident does not have the means to pay raises serious questions of disparate impact and environmental justice.
- The public plays a critical role in protecting their families' health by reducing exposure to lead and copper, and informing the public enables them to be effective participants in implementing their share of the responsibility.
- The issues associated with lead and copper are very different and warrant more separate attention than has been the case in the past.
- The LCR should remain a treatment technique rule, but it can be improved.
- Corrosion control treatment (CCT) is complex, dynamic, and varies based on the circumstances in each PWS. The understanding of the challenges with CCT has improved in recent years, but questions still remain.
- Attention to unintended consequences is important generally and, in particular, with respect to CCT.
- The presence of lead-bearing materials in premise plumbing raises issues about what systems can implement that requires attention.
- Attention to what States are able to oversee and enforce also is important.
- PWS and state resources should be focused on actions that achieve the greatest positive health outcomes.

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2.2 Regulatory Background and Formation of the NDWAC Lead and Copper Work Group

Under the Safe Drinking Water Act EPA sets public health goals and enforceable standards for drinking water quality.[1] The Lead and Copper Rule is a treatment technique rule. Instead of setting a maximum contaminant level (MCL) for lead or copper, the rule requires (PWSs) to take certain actions to minimize lead and copper in drinking water, to reduce water corrosivity and prevent the leaching of these metals from the premise plumbing and drinking water distribution system components and when that isn't enough, to replace lead service lines under their control. The current rule sets an action level (AL), or concentration, of 0.015 mg/L for lead and 1.3 mg/L for copper. An AL is not the same as an MCL. An MCL is based on health effects and feasibility; whereas an action level is a screening tool for determining when certain treatment technique actions are needed.

The LCR action level is based on the practical feasibility of reducing lead through controlling corrosion. In the LCR, if the AL is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the AL), it is not a violation, but triggers other requirements that include water quality parameter monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education, and lead service line replacement (LSLR). The rule also requires States to report the 90th percentile for lead concentrations to EPA's Safe Drinking Water Information System (SDWIS) database for all water systems serving 3,300 or more persons, and for those systems serving fewer than 3,300 persons only when the lead action level (LAL) is exceeded. States only report the 90th percentile for copper concentrations in SDWIS when the copper action level is exceeded in water systems regardless of the size of the service population. Public education requirements ensure that drinking water consumers receive meaningful, timely, and useful information that is needed to help them limit their exposure to lead in drinking water.

Copper is a common material used in household plumbing and drinking water service lines in the United States. Copper is an essential nutrient in small amounts; however, acute ingestion of excess copper in drinking water has been associated with adverse health effects, including acute gastrointestinal symptoms such as abdominal discomfort, nausea, and vomiting.

The SDWA requires EPA to set MCLGs at concentration levels at which no known or anticipated adverse effects would occur, allowing for an adequate margin of safety. EPA proposed an MCLG of 1.3 mg/l for copper in 1985, and finalized that MCLG in 1991 when the LCR was promulgated. The LCR set the action level (AL) for copper, the level at which treatment technique actions are triggered for the water system, equal to the MCLG. The AL is triggered if 90th percentile level of water samples is exceeded. All community water systems must report the 90th percentile level and the number of samples that exceeded the 90th percentile in their Consumer Confidence Reports.

In early 2004, EPA began a wide-ranging review of the implementation of the LCR to determine if there was a national problem related to elevated levels of lead in drinking water. As part of its national review, EPA collected and analyzed lead concentration data and other information, carried out a review of implementation in States, held four expert workshops to discuss elements of the regulations, and worked to understand local and State efforts to monitor for lead in school drinking water, including a national meeting to discuss challenges and needs. EPA released a Drinking Water Lead Reduction Plan (DWLRP) in March 2005. This plan outlined short-term and long-term goals for improving implementation of the

[1] EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

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LCR. The plan can be found at the following web address: [HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_review.cfm"]

In 2007, EPA promulgated regulations, which addressed the short-term revisions to the LCR that were identified in the 2005 DWLRP. These requirements enhanced the implementation of the LCR in the areas of monitoring, treatment, LSLR, public education, and customer awareness. These revisions were intended to better ensure drinking water consumers receive meaningful, timely, and useful information needed to help them limit their exposure to lead in drinking water.

A number of Safe Drinking Water Act (SDWA) amendments aim to reduce lead in drinking water by limiting the amount of allowable lead in plumbing materials that come into contact with drinking water. In 1986, the SDWA was amended to prohibit the "use of any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, in the installation or repair of (i) any public water system; or (ii) any plumbing in a residential or non-residential facility providing water for human consumption, that is not lead free". Lead Free was defined as solder and flux with no more than 0.2% lead and pipes with no more than 8% lead.

Congress again amended the SDWA in 1996, to prohibit the introduction into commerce of any pipe, pipe or plumbing fitting or fixture that is not lead free and to also require pipes, pipe or plumbing fittings or fixtures be in compliance with 3rd party lead leaching standards. These provisions ensure that only products meeting the lead free definition are sold in the U.S. and that pipes, pipe or plumbing fittings or fixtures are certified to be lead free.

The Reduction of Lead in Drinking Water Act of 2011 revised the maximum allowable lead content from not more than 8% to not more than a weighted average of 0.25% lead and included a calculation procedure for determining the weighted average; further reducing the amount of lead in contact with drinking water. It also eliminates the federal requirement to comply with the lead leaching standard and included exemptions from the lead free definition for plumbing devices that are used exclusively for non-potable services and also for specific plumbing devices such as toilets, bidets and urinals. The Community Fire Safety Act of 2013 further amended SDWA to add fire hydrants to the list of exempted plumbing devices.

EPA has continued to work on the long-term issues that required additional data collection, research, analysis, and full stakeholder involvement, which were identified in the 2005 DWLRP and the 2007 rule revisions. This action is referred to as the LCR Long-term Revisions (LTR). The LCR LTR would apply to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). In this report, the term public water system (PWSs) is meant to refer to both of these categories but not to transient non-community water systems.

Seeing the need for additional input on potential revisions to the Lead and Copper Rule, EPA requested that the National Drinking Water Advisory Committee (NDWAC) form the Lead and Copper Rule Working Group (LCRWG) to consider several key questions for the LCR LTR, taking into consideration previous input. The LCRWG met seven times in 2014 and 2015 to produce this report, and sought input from the NDWAC in advance of the last meeting to understand and address questions the NDWAC might have about the working group's recommendations.

A list of members of the working group is provided in Appendix A. [~~*add following approval*~~ This report was approved by ~~consensus of~~ the LCRWG, with one dissent.]

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3. Recommendations for Revisions to the Lead and Copper Rule

The long term revisions to the LCR is an important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential.

The LCRWG offers the following recommendations, based on information provided to the work group and on the work group's own deliberations. The LCRWG considers these recommendations to be an integrated package, not a menu of choices from which some recommendations can be selected and combined with others. This package reflects a concerted attempt to strengthen public health protection, which includes targeting the resources available to PWSs for the greatest public health value. While individual members might differ on specific recommendations, ~~it is the consensus of~~ the work group (with one dissent) agrees that this package of recommendations constitutes an improvement over the current LCR.

The LCRWG carefully considered the information and questions posed by EPA in a white paper prepared for the working group. In its deliberations, the LCRWG came to the conclusion that the lessons learned from the implementation of the current LCR warranted a fresh look at the premises of the regulation. To truly solve the problem of exposure to lead in drinking water, the LCRWG concluded that lead-bearing materials should be removed from contact with drinking water to the greatest degree possible, while minimizing the risk of exposure in the meantime. That premise has led to a different paradigm for a revised LCR and, thus, to a somewhat different set of assumptions than underlay questions posed to the working group.

The diagram on page I ~~13~~ illustrates the conceptual framework of the recommendations that follow.

The LCRWG specifically recommends that EPA revise the LCR to:

- Require proactive LSL replacement programs, which set replacement goals, effectively engage customers in implementing those goals, and provide improved access to information about LSLs~~s~~, in place of current requirements in which lead service lines (LSLs) must be replaced only after a lead action level (AL) exceedance and CCT;
- Establishes more robust public education, by creating a national clearinghouse of information for the public and templates for PWSs, by updating the Consumer Confidence Report, adding targeted outreach to consumers with lead service lines and other vulnerable populations (pregnant women and families with infants and young children), and increasing the information available to health care providers and the public;
- Strengthen corrosion control treatment (CCT), retaining the current rule requirements to re-assess CCT if changes to source water or treatment are planned, adding a requirement to review updates to EPA guidance to determine if new scientific information warrants changes;
- Modify monitoring requirements to provide for consumer requested tap samples for lead, and to utilize~~s~~ results of tap samples for lead to inform consumer action to reduce the risks in their homes, to inform the appropriate public health agency when results are above a designated household action level, and to assess the effectiveness of CCT~~.~~;
- Tailor~~s~~ water quality parameters to the specific CCT plan for each system, and increases the frequency of WQP monitoring for process control;

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- Establish a health-based, household action level that triggers a report to the consumer and to the applicable health agency for follow up;
- Separate the requirements for copper from those for lead and focus new requirements where water is corrosive to copper; and
- Establish appropriate compliance and enforcement mechanisms.

Although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other EPA offices; federal, state and local agencies and other stakeholders. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

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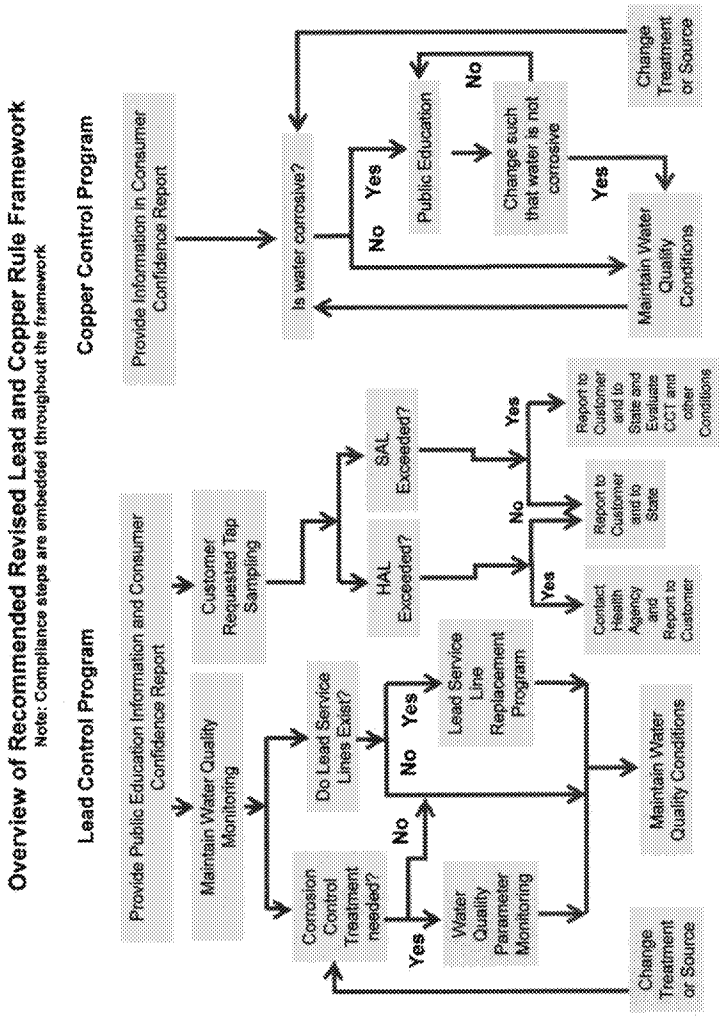
1 Figure 1


Overview of Recommended Revised Lead and Copper Rule Framework
Note: Compliance steps are embedded throughout the framework
Lead Control Program
Provide Public Education Information and Consumer Confidence Report
Maintain Water Quality Monitoring
Customer Requested Tap Sampling
Corrosion Control Treatment needed?
Yes
No
Water Quality Parameter Monitoring
Do Lead Service Lines Exist?
No
Yes
Lead Service Line Replacement Program
HAL Exceeded?
SAL Exceeded?
Yes
No
Contact Health Agency and Report to Customer
Report to Customer and to State
Yes
Report to Customer and to State and Evaluate CCT and other Conditions
Maintain Water Quality Conditions
Change Treatment or Source
Copper Control Program
Provide Information in Consumer Confidence Report
Is water corrosive?
No
Yes
Public Education
Change such that water is not corrosive
No
Yes
Maintain Water Quality Conditions
Change Treatment or Source

2

3.1. Replace Lead Service Lines[2]

Removing the sources of lead in drinking water should be a national goal. More proactive action than has taken place to date is needed to achieve it.

Although success in achieving this goal will require a concerted effort by many and can not be accomplished solely through the authorities provided under the Safe Drinking Water Act, revisions to the Lead and Copper Rule are an important component to achieving this goal and should be structured accordingly. [See Section 4 for recommendations that complement revisions to the LCR.]

The existing LCR has not created sufficient incentives to fully replace LSLs and other sources of lead , because LSL replacement is only required when the lead AL has been exceeded and optimizing CCT is insufficient to bring a system back under the action level. Systems that do not exceed the lead AL will never have to implement a LSL replacement program. Further, the link to action level exceedance does not allow adequate time for a well-planned LSLR program, and a significant unintended consequence where systems have had to implement a LSL replacement program quickly has been an increase in partial LSL replacement.

EPA asked the Science Advisory Board (SAB) to evaluate the current scientific data regarding the effectiveness of PLSLR and the review centered around five issues: (1) associations between PLSLR and blood lead levels in children; (2) lead tap water sampling data before and after PLSLR; (3) comparisons between partial and full LSLR; (4) PLSLR techniques; and (5) the impact of galvanic corrosion. The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of PLSLR in reducing drinking water lead concentrations. The small number of studies available had major limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating PLSLR efficacy.

While recognizing the limits to current data, the SAB concluded that PLSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months, and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to increase then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR. The SAB also concluded that in studies comparing full LSLR versus PLSLR, the evaluation periods were too short to fully assess differential reductions in drinking water lead levels. However, the SAB explained that full LSLR appears generally effective in reliable achieving long-term reductions in drinking water lead levels, unlike PLSLR. Both full LSLR and PLSLR generally result in elevated lead levels for a variable period of time after replacement. The limited evidence available suggests that the duration and magnitude of the elevations may be greater with PLSLR than full LSLR.

Taking all of these considerations into account, the LCRWG has concluded that an effective framework for replacement of LSLs would include the following and the LCR should be revised accordingly:

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[2] 40 CFR 141.2 definition: "*Lead service line* means a service made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line." ~~For the purpose of this report, the LCRWG includes both full and partial LSLs in this term.~~

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- Requiring all PWSs to establish a LSL replacement program that effectively informs and engages customers to share appropriately in fully removing LSLs, unless they can demonstrate that LSLs are not present in their system;
- Modifying the definition of lead service lines to include any service line where any portion, including a lead pigtail, gooseneck or other fitting, is made of lead;
- Clear guidance, case studies, and templates for LSL replacement programs, including a toolkit of ideas for creative financing strategies;
- Targeted outreach to customers with LSLs, with information about the risks of lead exposure, an offer to test a tap sample, and information about and encouragement to participate in the LSL replacement program;
- Dates by which systems should have met interim goals and completed replacement of all LSLs and PSLSs, without penalty to PWSs for those homeowners who refuse to participate in the replacement program as long as the PWS has made a meaningful effort to work with such a homeowner;
- Creating incentives for understanding where LSLs and PLSLs exist, while making action on full replacement rather than investigation of the location of LSLs and PLSLs the priority;
- Maintaining ongoing-outreach to homeowners where LSLs or PLSLs still exist;
- Implementation of standard operating procedures (SOPs), either from EPA guidance or tailored to the system, that helps define operations that disturb LSLs and practices to minimize disturbance and consumer exposure to lead.
- Stronger programs to educate consumers, and to provide test results of tap samples at the request of consumers; and
- Focus efforts on action to replace LSLs rather than on the time and expense of upfront plan approval and on using simplified reporting to the states so they would only need to intervene when problems arise.

- Requirements that provide strong encouragement for full LSL replacements, with the understanding that there may be justifiable exceptions and that those exceptions would occur only after the efforts outlined in the recommendations below on the part of the PWS to work with customers to complete a full LSL replacement. Such exceptions might include emergency repairs where property owners have refused to participate in a full LSL replacement or when a sufficiently high percentage of property owners participate in an area-wide LSL replacement or main replacement program to justify replacing LSLs to the property lines of those who do not participate at the time. Revisions to the LCR should include options for risk management to occupants of those properties with remaining, partial lead service lines, e.g. additional sampling, filters, dielectrics to reduce the risk of galvanic corrosion, plastic piping, aggressive premise flushing, etc.
- ~~Prohibition of partial LSL replacements except during emergency repairs.~~

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3.1.1. Update inventories and improve access to information about lead service lines

Updating and improving access to information about the location of both full and partial lead service lines is both essential to ensuring LSLs are replaced and important for successful, proactive outreach to customers who are most likely to have a LSL.

The LCRWG recommends combining:

1) The presumption that a service line put in place prior to the date when lead service lines were prohibited has lead materials unless the PWS has information to confirm that it not, with

2) Providing credit to a PWS toward its replacement goals for demonstrating that a service line does not have lead materials.

This approach is intended to create incentives for prompt action to develop an accurate inventory of LSLs and PLSLs in part by being overly conservative initially on the potential existence of LSLs, time to organize an effective replacement program, and an opportunity to take action to replace LSLs rather than devoting time and resources on planning documents that must be approved by the primacy agency.

The LCRWG recognizes that PWSs vary in the amount of information they have about the location of full and partial LSLs.

The LCRWG also recognizes that the current definition of a lead service line exempts a service line that has a lead pigtail or gooseneck or other fitting but is otherwise not made of lead. We recommend that the LCR be revised to remove this exemption since a lead pipe, even if only a small portion, poses a sufficiently similar risk as a full lead service line. Because utilities may not know where these portions are and may not be able to locate them without excavating the work, we recommend that the presumption described above not apply to lines where the utilities has not information or is unaware of their use. Finally, we recommend that these fittings be replaced when they are encountered during excavations and that the applicable operations and customer engagement requirements described in the next section apply.

In addition, the LCRWG recommends that all PWSs should establish a clear mechanism for customers to access information on LSL locations (at a minimum). Detailed public education recommendations for both lead and copper follow in separate sections. With respect to information about LSLs, PWSs should:

- Have outreach materials that indicate that property specific information is available.
- Inform customers who may have LSLs about the risks of partial line replacement, who is responsible for paying for replacing the service line, and the legal basis of that determination.
- Provide information it has about LSLs to existing home owners and residents on request.
- Provide information to realtors, home inspectors, and potential home buyers on request
- Communicate that this information is subject to disclaimer for accuracy based on information available to utility.
- Develop a system to track LSL replacement.

Where a service line serves multiple dwellings or places such as schools or child care centers that have many children, EPA should establish a formula for giving an extra weight or numerical count to these lines in the initial inventory to recognize the additional children that would be affected and effectively prioritize replacement of these LSLs.

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3.1.2. Establish active LSL replacement programs

Proactive LSL replacement programs by PWSs and their customers are key to moving to a future in which lead is not in contact with drinking water. To accomplish this, the LCRWG recommends replacing the current regulations, in which LSL replacement is required only if a PWS has a lead AL exceedance and after the PWS takes action to operate CCT, because this has not resulted in the complete replacement of many LSLs across the country. [3]

Instead, a revised LCR should include a requirement that all PWSs with lead service lines prepare and implement a LSL replacement program, along with a combination of changes to the regulatory approach described in this report and supportive actions by other public and private agencies, customers and other stakeholders. Taking this approach has the advantages of making replacement of LSLs something all systems do and of establishing programs that are put in place in an organized and measured way.

Supportive actions include increased funding of federal lead risk reduction programs under the Department of Housing and Urban Development (HUD) to help fund customer-owned portions of LSLs and to consider federal tax deductions for this purpose. Additionally, states should pass legislation requiring inspection, disclosure and/or replacement of LSLs on sale of property, and when lines have been disturbed as part of a renovation. Details on these and other ideas are included in Section 4 of this report.

The LCRWG recommends that EPA include the following revisions to the LCR:

1. *Goal:* PWSs will ~~to~~ work with their customers to implement full replacement of all lead service lines in their service areas according to the milestones outlined in Table 1. Revisions to the LCR should maximize the likelihood of achieving this goal, consistent with the recommendations in this section. EPA should~~The LCRWG~~ urges PWSs to work with their customers to replace LSLs in their service areas more quickly, ~~but~~while recognizesing that the recommended approach of replacing LSLs in all PWSs with LSLs adds a new and potentially costly requirement for utilities and their customers with LSLs who currently are not and may not ever be triggered into a LSLR program under the current rule.

2. *Interim Milestones:* PWSs that identify LSLs in their inventory should be required to perform targeted outreach to customers on the inventory of LSLs and to work with them to replace LSLs according to a sequence of three-year milestones,[4] beginning 36 months after the effective date of a revised LCR. Milestones would be set at a faster pace in earlier years and would recognize progress may be more difficult to achieve in later years with those LSLs that remain at that time. Tables 1 and 2 provide an illustration of this concept. PWSs should be~~are~~ encouraged to contact a larger number of homeowners than needed for compliance, since some homeowners may fail to reply or may refuse to participate. If replacement goals are not met, the revised LCR should require increased efforts by the PWS in addition to the basic requirements suggested below. These additional efforts are intended to enhance interest in and incentives for customer participation in full LSL replacement. The details of this approach should be determined by EPA, with the intent of the LCRWG being that the PWS be given the flexibility to choose among options and that the number of required efforts would increase over time if replacement goals are

[3] EPA estimates that there were approximately 10.5 million LSLs in 1988 before the promulgation of the LCR and approximately 7.3 million LSLs now.
[4] Three years is a standard reporting timetable for drinking water regulations.

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not met. EPA should seek to add to the initial list of options suggested in Table 2, taking into account what systems of different size and ownership have the ability to implement, and should set the number of required efforts with consideration for the number and feasibility of choices provided.

3. *Replacement Credit:* The following actions can be counted toward the cumulative replacement requirement:

   - Full LSL removal
   - Confirmation that an LSL included in the initial inventory is not lead.

   PLSLR will not be counted toward this requirement. Lack of response or refusal to participate by the customer also will not count toward replacement milestones.

4. *Targeted Outreach*: EPA should create a checklist in the rule of approved outreach methods for contacting customers with LSLs and inviting them to participate in the utility's LSLR program. Table 2 provides examples. EPA also should provide guidance and/or templates for these methods to encourage best practices in customer communication. For compliance purposes, the revised LCR should require that a PWS individually notify customers with known or possible LSLs describing the risks of lead in drinking water, specifically inviting them to participate in the LSLR program, and clearly describing the terms of the program, and how to follow up. If the customer does not respond or chooses not to participate, the PWS must follow up with another invitation at least every three years and always when there is a new customer at that address.

5. *Control and Responsibility:* The revised LCR should require PWSs to clearly state how the PWS defines ownership of LSLs, who has what financial responsibility for the replacement, what the legal basis is for that determination and any financial assistance programs that may be available.

6. *Planning and Financing Options:* EPA should provide a template and guidance for planning LSL replacement programs, including reference to options to assist customers replace their portion of lead service lines. Small systems may wish to refer to a national information source, such as one provided by EPA; large systems may wish to tailor such information to their circumstances. (See section 4.0 for further detail.)

   ~~Financial assistance and affordability options EPA may want to describe in guidance and PWSs could consider include but are not limited to:~~

   a. ~~Rate design considerations:~~
      i. ~~Low rates for low volumes~~
      ii. ~~Household size based rates~~
   b. ~~Non-rate policies~~
      i. ~~Budget billing~~
      ii. ~~Fixture retrofits and plumbing assistance by the PWS~~
      iii. ~~Service line replacement and insurance programs not provided by PWS~~
      iv. ~~Direct assistance, emergency bill payment reistionships~~
      v. ~~Fixture retrofits and plumbing assistance by NGO organizations providing affordable housing~~
      vi. ~~Subsidies including LSL / connection replacement costs associated with street, sidewalk, and other repairs not related to drinking water infrastructure~~
      vii. ~~On-bill financing provided by the PWS~~
   c. ~~Funding guidance~~
      i. ~~EPA's Financing for Environmental Compliance—Water~~

ii. ~~Tools for Financing Water Infrastructure~~

d. ~~Funding sources beyond rate revenue:~~

i. ~~EPA's Drinking Water State Revolving Fund (DWSLF)~~

ii. ~~USDA's Water and Environmental Programs, U.S. Department of Agriculture, Rural Development~~

iii. ~~HUD's Community Development Block Grant Program – U.S. Department of Housing and Urban Development~~

iv. ~~EPA Targeted Grants to Reduce Childhood Lead Poisoning~~

v. ~~HUD Healthy Homes Technical Studies~~

vi. ~~HUD Office Healthy Homes and Lead Hazard Control Lead Hazard Reduction Demonstration Program~~

vii. ~~HUD Health Homes Initiative Lead Elimination Action Program~~

viii. ~~HUD Office of Healthy Homes and Lead Hazard Control Lead Hazard Control Lead Technical Studies Grant Program~~

~~The LCRWG recommends that:~~

- ~~EPA clearly state the prioritization of LSL replacement within the planning priorities of the EPA drinking water infrastructure needs assessment as a subcategory of transmission and distribution, so that the national estimates of necessary water infrastructure needs include this new mandate.~~
- ~~EPA seek an increase of approximately $40 million to the base Drinking Water SRLF appropriation (approximately 0.5% of the current allotment received by the top 15 states) each year of the first three years after adoption of the revised LCR, reserving those funds for PWSs to use for LSL replacement pilot programs to place into operation the funding alternative method also being recommended to EPA. These pilot programs would further refine current recommendations and develop new methods of service delivery for LSL/ connection replacement.~~
- ~~Regardless of the programs the PWS is required to create to work with customers to replace LSL/ connections, a recommendation to EPA is prior to implementation of a new mandate from a changed LCR to replace LSL/ connections, the PWS determine the affordability for the customers within their service area. PWSs may use methodology from Manual M1 (Principles of Water Rates, Fees, and Charges Rate Manual) or Rattelle (Water and Wastewater Finance and Pricing, 4th Edition 2015) or a combination of both, and that the method used determines household relative affordability EPA (National Drinking Water Advisory Council 2003). The governing board of the PWS will adopt household relative affordability as policy and if the PWS rate applied to the customers exceed that adopted policy, the prioritization of needs and expense will be funded as determined by that governing board.~~

7. *Operations and Customer Engagement:* EPA also should provide guidance on PWS policies and procedures for how to engage customers in full lead service line replacement and to inform them on appropriate risk reduction measures. PWSs should adopt templates provided in guidance by EPA or, for larger systems, their own standard operating procedures (SOPs) and make them available to their customers and the primacy agency for:

a) planned capital projects by the PWS that would require:
   - Prior notification (e.g., 45 days prior to planned main replacement or repair) - Contact letter to affected households likely to have lead service lines, providing

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information about lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
- Reminder of flushing post LSLR (e.g., 48 hours prior to actual field work affecting structure) -- Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

b) emergency main and service line repairs by the PWS that would define how to manage potential disturbance to LSLs safely:
- Direction to information on lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
- Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

c) flushing of service lines after lead service line replacement:
- flush outside hose bib
- Initial flush followed by house flush by homeowner or plumber using multiple taps to maximize water velocity
- Information on proper use of filters when lead levels might be high

d) Requiring PWSs to inform ~~that when the activities of~~ other utilities (e.g. power, cable) whose work might affect~~s~~ water service lines or water mains, both proactively and at "mark out" for specific projects, ~~to: Provide information to the other utility~~ about how to manage potential disturbances safely and about information to provide residents of affected homes about potential risks and risk mitigation measures. Those other utilities would have the responsibility to alert residents.
- ~~Alert affected residents to information on flushing and the proper use of filters when lead levels might be high~~

8. Community and NTNC water systems (schools, hospitals, churches, jails, etc.) who own the system and control the entire distribution system should replace LSL's as soon as practical, at a timetable to be determined by EPA. This requirement would not apply to community systems where the majority of the connections are individual residential connections (such as mobile home parks and HOA's) where there may be complications due to property ownership of the residence. ~~A revised LCR also should require that *[insert intended category]* water systems that own their own pipes (e.g. hospitals, churches, schools, jails, etc) should replace lead piping within XX years of the effective date of the revised LCR.~~

The LCRWG discussed and agreed that EPA guidance should encourage PWSs to make every effort to ensure that LSL replacement provides equal protection to low income customers (or rental units with low income residents), people of color and others protected by civil rights law and policy. Environmental justice and civil rights considerations are particularly important in those jurisdictions where the PWS requires the property owner to pay a share of the costs of removing the LSL. Making environmental justice a priority can be achieved through creative financing programs for low-income customers and setting priorities for which neighborhoods are targeting first for LSLR to ensure equal treatment of low income neighborhoods.

The LCRWG also discussed but did not agree that the definition of control as ownership should be changed in the revised LCR. In the current lead and copper rule, when a system exceeds the LAL, EPA requires water systems to replace only that portion of the LSL that it owns. This is based on EPA's current interpretation of the term "control" in the definition of public water system as limited to ownership. Some members of the LCRWG urged that the current definition of control as "ownership"

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should be replaced with a requirement that PWSs must replace the entire LSL, where they have the authority to "replace, repair, or maintain" the line or where they have other forms of authority over the LSL. However, the LCRWG also recognized that some utilities are prevented by law from spending public funds on private property and that gaining physical access to private property poses significant legal issues when a property owner objects.

The LCRWG does agree that the revised LCR should require PWSs to inform customers about the scope of their responsibility with regard to LSL replacement and the legal basis for that decision.

3.1.3 LSL Compliance

3.1.3.a LSL Replacement Compliance

Recordkeeping:

- Inventory of LSLs
- Customer refusals to participate in full LSL replacement

Reporting: At the end of each three year period, each PWS must provide to the primacy agency:

- Certification of the outreach and other efforts conducted (see above for outreach requirements);
- Report on the change in the number of LSL removed from the inventory with better information;
- Report on the number of full LSL removed; and
- Report on locations where the utility side LSL was removed, but the homeowner refused to replace private portion

Violations:

- Failure to conduct required outreach;
- Failure to step up intensity of outreach efforts if 3-year LSL replacement target has not been met;
- Failure to provide on-going outreach (at least every 3 years) to locations with full or partial LSL
- Outreach materials do not meet the content requirements of the rule

Commented [GB1]: NEW – Edit to match the decision made at June meeting (reflected in item 4 on p.17 above and on Table 2)

3.1.3.b Operations and Customer Engagement Compliance

PCWS must maintain records of who was notified, when notice was given, and content of notice for each capital project. (for 7a and 7b)

Violations:

- Lack of timely notice to customer that LSL removal is scheduled
- Notice materials do not meet rule content requirements

PCWS also must develop SOP, and maintain records that it was provided to all utilities conducting activities which may impact LSL (for 7d)

Violation:

- PCWS has not developed an SOP (or adopted an SOP template available on the National Clearinghouse) or not provided it to other utilities

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3.2 Develop Stronger Public Education Requirements and Programs for Lead and LSLs

Given the public's role in the shared responsibility nature of the LCR, notifying and educating the public about lead in drinking water is important for risk reduction. Public education about the risks of lead in drinking water also is important regardless of whether LSLs are present, since lead can be present in other premise plumbing materials. Moreover, targeted outreach and, possibly, other efforts are a key to the success of LSL removal programs. The current LCR does not adequately focus on creating on-going opportunities to educate customers on the risks of LSLs or on opportunities to replace them, especially when action is most likely, e.g. at the sale of a home.

The objectives of public education programs should include consumer understanding of: 1) the risks of lead in drinking water; 2) the likelihood that the water in one's home may contain lead; 3) the LCR as a "shared responsibility" rule; and 4) the availability of additional resources that consumers can use to better minimize their exposure to lead.

Although the LCRWG was briefed on and has experience with public education requirements and practices, it does not include members whose specific area of expertise is consumer-centered risk communication. Thus, the LCRWG generally recommends that public education programs for lead should move away from past practices of one-way communication from "experts" to the "public" toward newer concepts of risk communication that involve sustained, multiple, two-way channels of ongoing communication and partnership with the public.[5] EPA should consult with those with such expertise about the outreach and communication recommendations in this report, and encourage and apply best practices in effective ways to communicate with the public.

Communication in languages appropriate to the demographics of the community, in clear terms understandable by the public, and with engaging, reader-friendly graphics, photos, and video all help achieve greater understanding. Outreach programs and materials can be improved by involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies. This information can and should be conveyed in different ways and through different communication channels, tailored to the specific circumstances.

Thus, with these and other considerations in mind, the LCRWG recommends that EPA, in consultation with the aforementioned stakeholders and drawing on principles of consumer-centered risk communication:

[5] Resources include: 1) EPA's "Risk Communication in Action" ([HYPERLINK "http://nepis.epa.gov/Adobe/PDF/60000I2U.pdf" \t "_blank"]) ; 2) EPA's "7 Cardinal Rules of Risk Communication" ([HYPERLINK "http://www.wvdhhr.org/bphtraining/courses/cdcynergy/content/activeinformation/resources/epa_seven_cardinal_rules.pdf"]); and 3) Education & Communication WG Report 2010; National Conversation on Public Health and Chemical Exposures ([HYPERLINK "http://www.resolv.org/site-nationalconversation/files/2011/02/Education_and_Communication_Final_Report.pdf"])

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- Establish an easily accessible, national clearinghouse of information about lead in drinking water to serve the needs of the public and of public water systems (section 3.2.1).
- Require information be sent to all new customers on the potential risks of lead in drinking water (section 3.2.2)
- Revise the current CCR language to address lead service lines and update the health statements (section 3.2.3).Add requirements for targeted outreach to customers with lead service lines (section 3.1.1).
- Strengthen requirements for public access to information about lead service lines, tap monitoring results, and other relevant information (section 3.2.4).
- Expand the current requirements for outreach to caregivers/health care providers of vulnerable populations (section 3.2.5)

As part of~~In addition, the LCRWG recommend, that~~ EPA's consultation with the aforementioned communication experts and stakeholders, the LCRWG recommends that EPA include consultation about methods that would increase public awareness of and motivation to learn about the effects of lead in drinking water and the benefits of removing these materials and/or taking regular precautions when cooking or drinking, regardless of whether LSLs are present or there has been a lead AL exceedance. Consistent with~~Based on~~ this advice, EPA also should take small systems into account and ~~also~~ consider whether such methods should be included in guidance or in revisions to the LCR.

3.2.1 National Lead in Drinking Water Clearinghouse

The LCRWG recommends that EPA take the lead, working with other partners to establish a national, accessible information clearinghouse. The LCRWG suggests that this information clearinghouse include a website, that the materials on the web site be accessible for distribution through the Safe Drinking Water Hotline for those who may not have internet access, and that EPA investigate and apply newer communication technologies and ideas for interactive or other innovative means of communication with the public about lead in drinking water (e.g. social media methods and outreach programs).

The clearinghouse should include information in multiple languages, in clear terms understandable by the public, and should include engaging, reader-friendly graphics, photos, and video. ~~In developing this clearinghouse,~~ EPA is encouraged to include the design of the clearinghouse in its consultation with people with diverse, and consumer-oriented expertise and perspectives described above~~, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies~~.

Such a clearinghouse would be intended for use by the general public, PWS's, public health agencies, and health professionals. It should include:

- ~~It should include~~ information and educational materials for the public that the public could access directly and that PWSs could use to meet many of the public education requirements of the LCR.
- ~~It also would include~~ guidance and templates, particularly for small systems, on SOPs for compliance with the LCR (e.g. templates for communicating lead monitoring results to individual customers, templates for explaining to customers how to obtain information on whether their service line could be lead, templates for standard operating procedures related to the LSL replacement program recommendations above, etc).

- Principles and guidelines for best practices in ~~public education would be important for~~ developing the content of the public education materials.
- Case examples of how communities have been successful in lead inventory updates and removal programs, information about funding sources, model ordinances or other types of authorities PWSs have to enable them to implement full LSL replacements, and contacts to other relevant agencies ~~also should be included.~~

Further, EPA should consider best practices in methods for achieving greater public awareness of the clearinghouse so that it reaches as many people as possible.

The web site should include the following information:

Health risks

- Clear and prominent statement that no level of lead in drinking water is safe for human consumption and that a short-term exposure to a young child can result in permanent harm to the brain if the levels are high enough.
- Clear and distinct language on the health risks of consuming lead in drinking water
- Identification of the most vulnerable populations
- Importance of drinking water plumbing as a lead source
- How to have BLLs checked and limitations of testing
- How to have water tested and limitations of testing
- List of labs for testing water other than the utility and what to ask for in terms of number and size of bottles, diameter of mouth of bottles, analysis that measures lead particles, etc.

Forms of lead in water and health risk implications

- Soluble
- Particulate
- Unpredictability of lead release

Sources of lead in drinking water

- LSLs
- Other lead-bearing plumbing
- Scale on internal plumbing that can be a source of lead from present or past LSLs

Identification of service line material

- How to recognize a pipe that is made of lead (and when not to check due to age of home)
- What to do about galvanized pipe and why it is a potential source of lead

For homes with LSL

- LSL ownership
- Difference between full and partial lead service line replacement (physically and in terms of health risks)
- Benefits to full LSL replacement
- Actions to take if you have a partially replaced LSL
- Available methods for LSL removal
- Opportunities for removal, approximate cost, and financing options
- Overall benefits to the community of removing LSLs fully (lower treatment costs, better community health, environmental, etc.)
- Where applicable, requirements for notification during real estate transfer or new rental

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Health-protective actions

- Precautionary water-use practices
- Role of filters and proper maintenance of them if they are used
- Replacement of leaded plumbing with lead-free plumbing

Additional information

- How to contact your utility and request a LSL inspection and/or water test
- Where applicable, reference to utility-specific website with local lead-related documents and data (e.g. Consumer Confidence Reports (CCRs), sampling protocol used for LCR compliance, lead-in-water test results, etc.)
- What you need to know about lead in water in schools and day care centers (it is not regulated, and link to national website that provides more information)
- Reference to a national website that provides a video version of basic educational information, including information on how the LCR works (with minority language versions)
- Other standard operating procedures, model ordinances, or templates for compliance with the revised LCR
- Where to get more information on drinking water, on lead in water, and on lead in general

3.2.2 Outreach to New Customers

The LCRWG recommends that a revised LCR require PCWSs to provide information to all[5] new customers in a letter or via other direct means on the potential risks of lead in drinking water.

The outreach materials should include information about the potential for lead from plumbing materials to contaminate drinking water even when a PCWS meets the LCR LAL, to contaminate drinking water in homes with and without LSLs, and to pose chronic and acute health risks to vulnerable populations. The specific information to be covered in those materials could be included in the consultation with the determined by a diverse group of experts as described in the introduction to Section 3.2 above and in Section 4 below. Although the LCRWG defers to such a group, it suggests that at a minimum the following topics be covered:

1. Information about lead in drinking water (its sources, variable and erratic release, and wide range of lead concentrations)
2. Information about the health effects of lead in drinking water (including chronic and acute health risks)
3. Information about the LCR's shared responsibility regime
4. Actions the PCWS is taking to minimize lead in drinking water
   - PCWSs with LSLs would mention their proactive LSL replacement program
5. Steps consumers can take to reduce exposure to lead in drinking water
   - In addition to a list of actions like the ones mentioned in the current Rule, PCWSs with LSLs would spell out how consumers in homes with a LSL can participate in their proactive LSL replacement program
6. Phone numbers and online links for additional information (including a link to EPA's online National Clearinghouse)

The outreach to new customers should be delivered within 30 days or with the first bill.

[5] EPA may wish to consider circumstances under which exceptions might be applicable.

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3.2.3 Revise the Current CCR Language

The CCR is a necessary but not sufficient source of information for the public. It can provide general information, but is not designed to be frequent or detailed enough for all public education purposes.

All community water systems (CWSs) should continue to include a statement about lead in their CCR. There may be circumstances (e.g. a subdivision built entirely after January 2014 when "lead-free" requirements came into effect), where a CWS can demonstrate that there are no lead-bearing materials in contact with drinking water. EPA may want to consider allowing the primacy agency to waive this CCR language requirement if an entire CWS can meet this criterion.

The LCRWG recommends that the CCR language should be strengthened to include:

- Public health statements updated to reflect current understandings that there is no safe level of lead and a summary of the health effects, that this risk pertains to everyone, and that some individuals are particularly vulnerable;
- A link to the national clearinghouse should be added to the CCR for all CWSs;
- Recognition that a CWS's compliance with federal regulations does not guarantee what level of lead (lower or higher) might be found at the tap in a particular home; and
- The message that customers play an important role in protecting themselves from exposure to lead.

In addition, the work group recommends that PWSs where full or partial lead service lines exist (or are presumed to exist until an inventory demonstrates otherwise) also add information about what a lead service line is and how to contact the utility for information about how to find out if you have one and why you should replace it.

Further, the LCRWG recommends that the following redraft of the CCR be considered as a starting point for incorporating the elements listed above, to be reviewed by ~~the~~ diverse group of experts that the LCRWG suggests EPA consult ~~experts involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-oriented risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies~~.

> ***Important Information from EPA about Lead*** *If lead is present in your drinking water, it ~~elevated levels of~~ can cause serious health problems, especially for pregnant women and young children. Lead can affect children's brains and developing nervous systems, causing reduced IQ, learning disabilities and behavioral problems. Lead is also harmful to adults. Lead in drinking water is primarily from materials and components associated with ~~service lines and~~ home plumbing and service lines (the pipe connecting your home to the water main). ~~(System name) is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components.~~ Contact us for information about lead service lines, how to find out if you have one and why you should replace it. [Last sentence for systems with LSLs.]*
>
> ~~*When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.*~~ *Protecting you against exposure to lead is a shared responsibility. Your water utility is required to minimize the corrosivity of the water. However, because every home is different, the amount of lead in your tap water may be lower or higher than the monitoring results for your*

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public water system as a whole. You can take responsibility for identifying and removing lead materials within your home plumbing and taking steps to reduce your family's risk. If you have lead service lines or lead-bearing materials in your home, ~~are concerned about lead in your water,~~ you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at 1-800-426-4791 or [HYPERLINK "http://www.epa.gov/safewater/lead"]. *[Insert new national web site link]*

3.2.4 Strengthen Requirements for Public Access to Information

The LCWWG supports the public's right to know about the quality of their water and considered various options to increase the public's access to data related to lead and copper.

Under the current rule, the PWS is only required to make publicly available through the Consumer Confidence Reports (CCR) that "90th percentile value of the most recent round of sampling and the number of sampling site exceeding the action level." 40 CFR 141.153. In many jurisdictions, a concerned consumer may be able to obtain or view a redacted version of the complete sampling data set but this approach is time-consuming and burdensome on the PWS (or the state) and the community. EPA receives only a summary of the sampling results.

As the LCRWG evaluated different approaches, we kept in mind EPA's Office of Enforcement and Compliance Assurance (OECA) five principles for highly effective regulations and that OECA is working with regulatory programs to evaluate new and revised rules against these principles. Principle 4 calls for rules to "leverage accountability and transparency by providing the government and the public with real-time access to quality information on regulated entities" emissions, discharges and key compliance activities and outcomes." OECA identified two tools to accomplish this:

- Electronic reporting to the government.
- Public accountability via websites, paper/electronic mailings, and other ways to provide the public and stakeholders (e.g., customers, ratepayers) with compliance information.

The LCRWG encourages EPA to use the SDWIS-Prime data system[7] that is under development to meet the first provision of the above goal. Electronic reporting from utilities to a centralized data system would allow the public to access data from the State or EPA in a coordinated manner and allow for consistent access to all water quality data, not just data for lead and copper.

Until such time as the new data system is in place, though, the LCRWG believes that water systems should increase the availability of data to the public. This would include:

- The number of samples over the Household Action Level (described in Section 3.5 below) in the last monitoring period, the highest level found during the last monitoring period, and the median levels as well as the current "system action level" (renamed from the current action level).

[7] SDWIS is a database for storage about drinking water systems. The federal version (SDWIS/FED) stores the information EPA needs to monitor approximately 156,000 public water systems. The state version (SDWIS/STATE) is a database designed to help states run their drinking water programs. SDWIS-Prime is an upcoming version of this program. The website for SDWIS is located here:
[HYPERLINK "http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/index.cfm"]
SDWIS Reports:
[HYPERLINK "http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/howtoaccessdata.cfm"]

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- Requiring water systems to include WQP-related information on their webpage, or in the CCR or some equally accessible manner (e.g., CCT treatment, approved WQP ranges, WQP results from the last monitoring period)
- Encouraging water systems to post additional information on their webpages such as:
  - Public education materials (and link to National Clearinghouse)
  - Sampling protocol the water system provides to customers to use when collecting lead sample and any variations from EPA recommendations.
  - Individual sampling results (with appropriate privacy provisions such as address redaction)
  - Inventory (such as a map) of confirmed and presumed lead service lines

Where a community has lead service lines, EPA should require PWSs provide a public statement of lead service line ownership and the legal basis of said determination. (See section 3.1.2, point 5 *"Control and Responsibility."*)

3.2.5 Routine outreach to caregivers/health care providers of vulnerable populations

~~The LCRWG recommends that a revised LCR require CWSs to institute locally appropriate and ongoing public education programs targeted at caregivers and health providers of the populations most vulnerable to lead in drinking water (i.e., fetuses, infants, young children, and children with elevated BLLs). The intent of such outreach is to raise awareness among caregivers and health providers about the health risks of lead in drinking water, easy steps to prevent exposure, and the availability of EPA's online National Clearinghouse for further information. It is expected that public education messaging in service areas with LSLs will differ from public education messaging in service areas without such lines.~~

The LCRWG ~~also~~ recommends that a revised LCR ~~encourage~~require PCWSs to cooperate in locally appropriate public education programs targeted at caregivers and health providers of the populations most vulnerable to lead in drinking water (i.e., ~~pregnant women fetuses~~, infants, young children, and children with elevated BLLs). The intent of such outreach is to raise awareness among caregivers and health providers about the health risks of lead in drinking water, easy steps to prevent exposure, and the availability of EPA's online National Clearinghouse for further information. It is expected that public education messaging in service areas with LSLs will differ from public education messaging in service areas without such lines.

~~Under the current Rule[A], there is no required outreach other than the CCR except when a CWS exceeds the LAL; the CWS is then required to implement a public education program that covers the following topics (EPA 2008,~~
[HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/upload/Lead-and-Copper-Rule-Public-Education-Other-Public-Information-Requirements-for-Community-Water-Systems-Fact-Sheet.pdf"]~~):~~

~~1. Information about the LAL exceedance~~
~~2. Information about health effects of lead (general)~~
~~3. Sources of lead in the environment (general)~~
~~4. Steps to reduce exposure to lead in drinking water (e.g., flush, avoid hot tap water, use alternative sources of drinking water, replace lead-bearing plumbing fixtures, conduct water testing, conduct BLL testing, do not boil drinking water for lead elimination)~~
~~5. Actions the CWS is taking to address the contamination~~

~~[A] See CFR 141.85(b)(2).~~

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~~6. Phone numbers and online links for additional information~~

~~During the exceedance of the LAL, this information is to be delivered annually to facilities and organizations likely to be visited by pregnant women, infants, and young children (i.e., local public health agencies; public and private pre-schools, schools, or school boards; Women Infants and Children (WIC) and Head Start programs; public and private hospitals and medical clinics; pediatricians, obstetricians-gynecologists, and midwives; family planning clinics; local welfare agencies; licensed childcare centers). The current LCR suggests that the delivery of the information take place through a broad range of communication vehicles, including:~~

- ~~Public Service Announcements~~
- ~~Paid advertisements~~
- ~~Information displays in public areas~~
- ~~Emails to customers~~
- ~~Public meetings~~
- ~~Information delivery to every household as well as multi-family homes~~
- ~~Other methods approved by the primacy agency (here we would include social media)~~

In conducting outreach to caregivers and health care providers it is important that the message be provided by an organization or individual that carries credibility with those audiences. The LCRWG suggests the way to best ensure that caregivers and health providers hear and respond appropriately to information about lead and drinking water is for water suppliers to participate in joint communication efforts, lead by state health departments, state lead poisoning prevention agencies, and state drinking water primacy agencies. This outreach should be targeted to individuals, organizations and facilities likely to be visited by the vulnerable populations of pregnant women, infants, and young children:

1. local public health agencies;
2. public and private pre-schools, schools; Women Infants and Children (WIC) and Head Start programs;
3. public and private hospitals and medical clinics;
4. pediatricians, obstetricians-gynecologists, and midwives;
5. family planning clinics;
6. local welfare agencies; or
7. licensed childcare centers.

The outreach efforts should make use of the information provided in the clearinghouse ~~include the following types of information:~~

~~1. Information about lead in drinking water (its sources, variable and erratic release, and wide range of lead concentrations)~~
~~2. Information about exposures route of lead in drinking water to different vulnerable populations, including bottle-fed infants~~
~~3. Information about lead service lines~~
~~4. Information about the LCR's shared responsibility regime between water system and customer~~
~~5. Actions that GWSs typically take to minimize lead in drinking water, or the actions of the specific system participating in the outreach~~
~~6. Mechanisms for linking patients or customers to their specific PWS~~
~~7. Steps consumers can take to reduce exposure to lead in drinking water, including removal of LSL~~
~~8.~~ 1. ~~Phone numbers and online links for additional information (including a link to EPA's online National Clearinghouse)~~

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Examples of communication vehicles that might be suggested in guidance materials include:

- Development and routine delivery of a joint communication from the PCWS (or a group of PCWSs) and the City/State to:
  - Health providers (e.g., OBGYNs, pediatricians, midwives)
  - Childhood lead poisoning prevention professionals/organizations
  - Professionals at licensed daycare centers and schools
  - Listservs/organizations for pregnant women/parents of infants (e.g., local listservs, environmental health groups, La Leche League, etc.)
- Delivery of educational materials during any water-related work at customer homes
- When lead-in-water levels at individual homes test above the HAL, delivery of information to a) the residents at the home and b) City/State health departments. These materials ought to cover information prescribed in the current LCR for public outreach during a LAL exceedance as well as:
  - The lead level detected at the specific home
  - What this level means in terms of health risk to vulnerable individuals
  - If the PCWS determines that the home has a LSL, information about how to participate in the PCWS's proactive, full LSL replacement program.

The LCRWG also recommends that EPA, informed by the advice of the diverse group of experts described above and working with CDC, HHS and HUD, develop guidance (and make it available through the National Clearinghouse) on how to develop and deliver effective communication efforts to caregivers and health care providers focusing on ways those individuals and groups can reach pregnant women, parents of infants and young children and those who care for them. The audience for those materials would be state primacy agencies, state or local health departments, and state or local lead poisoning prevention agencies, as well as PCWSs.

To support PCWSs in the development of feasible, locally appropriate, and successful public outreach programs targeting vulnerable groups on a routine basis, the LCRWG recommends the following: that the diverse group of experts EPA may convene for the development of consumer-centered public education messaging and materials (see introduction to Section 3.2), also develop guidelines and best practices that PCWSs can use to create proactive risk communication programs. Echoing extant principles and understandings of effective risk communication,[9] we imagine such programs to involve robust collaboration between PCWSs, many of the local public health agencies and organizations listed above, as

[9] Lundgren, R. E. and A. H. McMakin. 2013. *Risk Communication: A Handbook for Communicating Environmental, Safety, and Health Risks*. Hoboken, NJ: John Wiley & Sons, Inc.
Risk Communication in Action, [HYPERLINK "http://nepis.epa.gov/Adobe/PDF/60000I2U.pdf"]
Communicating about Lead Service Lines, [HYPERLINK "http://www.awwa.org/Portals/0/files/resources/publicaffairs/pdfs/FINALeadServiceLineCommGuide.pdf"]
Strategies to Obtain Customer Acceptance of Complete Lead Service Line Replacement, [HYPERLINK "http://www.awwa.org/Portals/0/files/legreg/documents/StrategiesforLSLs.pdf"]
National Conversation on Public Health and Chemical Exposures: Education and Communication Work Group Report, [HYPERLINK "http://www.utmb.edu/cet/downloads/Natl_Conv_Edu_Comm_WorkGroup%20Report.pdf"]
Advancing Collaborations for Water-Related Health Risk Communication, [HYPERLINK "http://www.waterrf.org/PublicReportLibrary/91145.pdf"].

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well as local childhood lead poisoning prevention groups (State-funded and grassroots), environmental health organizations, and key community leaders (e.g., advisory neighborhood commissioners).

Education of public health and health care providers on lead and water issues

The LCRWG had extensive discussions about the frustration that members of the group had that many in the public health community minimized the risk of lead exposure from drinking water, placed a lower priority on actions to reduce that risk, and frequently provided incomplete or conflicting information to members of the public or patients. This made and continues to make the work of water professionals in motivating appropriate action by customers more difficult. Those in the health sector are highly regarded, and viewed as knowledgeable about all health related topics. Customers will look to them for advice and to validate what they hear from their water provider. Efforts by water systems to reach out to their customers must be appropriately re-enforced by those in the health sector if those efforts are to be successful.

The LCRWG recommends that EPA, CDC, HHS and HUD conduct training and outreach to local health agencies, medical professionals and local and state lead poisoning prevention agencies on:

1. Information about lead in drinking water (its sources, variable and erratic release, and wide range of lead concentrations)
2. Information about exposures routes of lead in drinking water to different vulnerable populations, including pregnant women, infants and young children
3. Information about lead service lines
4. Information about the LCR's shared responsibility regime between water system and customer
5. Actions that PCWSs typically take to minimize lead in drinking water
6. Steps consumers can take to reduce exposure to lead in drinking water, including removal of LSLs
7. Phone numbers and online links for additional information (including a link to EPA's online National Clearinghouse)

The LCRWG also recommends that EPA work with CDC to incorporate in the CDC's website, educational materials, and materials used by CDC-funded childhood lead poisoning prevention programs nationwide, accurate and up-to-date information about lead in drinking water (its sources, variable and erratic release, wide range of lead concentrations, chronic and acute health risks, the LCR's shared responsibility regime, steps to prevent exposure).

3.2.6 Public Education Compliance

3.2.6.a Compliance for New Customer Outreach

Violations:

- Failure to provide information to new customers

3.2.6.b Compliance for CCR

Recordkeeping, reporting and violations: Same as in the current CCR rule, with updated content.

3.2.6.c PE Compliance for Public Access to Information

PWS must provide the public access to information about:

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- Number of samples over the Household Action Level, median and highest level found in the last monitoring period
- CCT treatment, approved WQP ranges and WQP results from the last monitoring period

Violations:

- Failure to make this information available to the public

3.3 Improve Corrosion Control

Corrosion Control Treatment (CCT) involves the addition of chemicals (e.g. orthophosphates or silicate) to create a barrier between the pipes and the drinking water, or to modify drinking water chemistry (such as pH and hardness) to inhibit the potential for corrosion. The concept is to manage the treatment system to reduce corrosion (and, thus, the release of metals such as lead and copper) from the distribution system and premise plumbing.

Under the current LCR, PWSs serving more than 50,000 people were required to work with their primacy agency (typically the state) from 1994 to 1997 to designate and install optimal corrosion control treatment. Systems serving 50,000 people or less must optimize corrosion control treatment only if the results of lead and copper tap sample exceed the action levels. A PWS exceeds the lead AL if ten percent or more of the tap samples collected are greater than the 15 ppb action level.

In evaluating CCT choices, a PWS must consider list of assessment parameters; and, as part of the approval of a PWS CCT plan, the state also approves a shorter list of process control parameters applicable to that system to demonstrate that the selected treatment is being properly operated over time. For purposes of this report, the term water quality parameters (WQPs) applies to these latter process control measures. Recommendations concerning WQPs are included in Section 3.4.

Based on the experience with current LCR requirements provided to this work group and shared by work group members, the LCRWG has concluded the following:

- CCT remains an important component of the LCR, in that it is intended to achieve a water quality that minimizes dissolution of lead and copper in water.
- Effective CCT varies based on the specific conditions from system to system. Increased knowledge about CCT since promulgation of the current LCR, if applied today, could lead to improvements in CCT in some systems. Thus, PWSs and their primacy agency should apply the most current science, tailored to the unique circumstances of each system, to the choice of treatment plan and its associated water quality parameters. A variety of factors affect the dissolution of lead in water, including but not limited to pH and alkalinity. Factors other than the stability of designated WQPs can include, among others, the formation/dissolution of protective scales; the presence of manganese, iron, chlorides, sulfates, aluminum and other materials; and temperature. Variations in water quality also can occur within the distribution system. These water quality conditions vary among PWSs, which in turn affect the CCT choices a PWS must make in in the context of other regulatory requirements.
- Lead also occurs in different forms in plumbing systems, from soluble to insoluble and particulate in nature. PWSs vary in their sources of lead from the very common leaded solder and brass fixtures/valves, to LSLs, and to less common lead-lined iron pipe. CCT is more effective in reducing exposure to soluble lead than it is for particulate lead, although CCT that contributes to the formation of certain scales may also provide benefits in reducing exposure to particulates.

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Thus, while very important, CCT is not the only lead control mechanism that a PWS must have in place. In other words, CCT should not be relied upon by itself to control lead in water. Rather, it should be one of a tool box of other required mechanisms depending on a PWS's particular conditions and lead sources (e.g. LSLs, lead solder, leaded brass, etc.). These tools are described in other sections of this report and include: LSL replacement (as well as the replacement of other less common sources of lead such as lead-lined iron pipe), current and future use of lead-free materials, stronger public education including targeted public education to vulnerable populations (pregnant women and families with infants and young children), availability of certified POU filters, instructions on how to flush plumbing systems when lead could be disturbed, etc.

3.3.1 Corrosion Control Recommendations

The LCRWG recommends that:

- EPA release a revised CCT guidance manual as soon as possible and update this manual every six years, so that PWSs and primacy agencies can take advantage of improvements in the science;
- EPA provide increased expert assistance on CCT to PWSs and primacy agencies;
- The LCR continue to require re-evaluation of CCT when a PWS makes a change in treatment or source water;
- The LCR continue to require WQP monitoring to ensure that the CCT is achieving the treatment objectives and that EPA consider requiring such monitoring on a more frequent basis with additional guidance on process control methods; and
- Large systems review their existing CCT plan in light of current science in a newly revised guidance manual with their primacy agency to determine whether the WQPs reflect the best available current science. The LCRWG suggests that this review be done every six years following EPA's six year rule review cycle, and subject to there being sufficient science change that EPA updated the guidance manual. EPA should plan to review and refresh Agency guidance every 6 years, subject to significant improvement in the state of knowledge, to allow research to inform rule implementation. In addition, regularly revised guidance would help states and systems stay current with corrosion control science as they respond to problem situations, but more importantly help them anticipate challenges as new water sources and treatments are brought on line, or they contemplate further refinement to corrosion control. Small and medium sized systems should work with their primacy agency to determine whether updates to CCT guidance is applicable to them.

3.3.2 Corrosion Control Compliance

PWS must maintain records that it reviewed new EPA guidance manuals and assessed whether and, if so, what changes to CCT are applicable, based on the current state of the science.

Violations:

- Failure to notify and consult with primacy agency on re-evaluating CCT if the PWS makes a change in treatment or source water
- Failure to review CCT when EPA updates the guidance manual (for large systems)
- Failure to act if state notifies them that they should assess CCT or make adjustments, based on state review of guidance manual (for medium and small systems)

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3.4 Modify Monitoring Requirements

Under the current LCR, a PWS is required to conduct monitoring to assess the effectiveness of its corrosion control treatment (CCT) 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. In the Lead and Copper Rule (LCR), water systems must prioritize sample site locations (often residences) within the distribution system which are at a high-risk of elevated lead and/or copper in the water. Selection and use of these elevated lead and copper sites enables a smaller number of sample sites than random or geographic site selection procedures.

Implementation of this approach over time has revealed numerous challenges. Recruitment of customers to take in-home samples can be difficult and costly. Customers are not professional samplers and, thus, may implement the sampling protocols inconsistently. Research on sampling protocols also has shown that sampling results may vary, and not necessarily consistently, based on the configuration and length of lines from the water main to the sampling tap and whether the sample is a first draw or a subsequent sample intended to reflect water that had been in a LSL for some time.

The LCRWG recommends two types of on-going monitoring: 1) a more robust WQP monitoring program to improve process controls for CCT, and 2) voluntary customer initiated tap water sampling coupled with a more robust and targeted public education program to encourage sampling, in part to provide direct information to consumers that they can use to reduce potential exposures to lead from drinking water in their home and to provide ongoing information to the PWS to identify and correct unanticipated problems.

The LCRWG also recommends that EPA establish criteria for a PWS to transition from the current rule framework into the new rule framework. A PWS must comply with the requirements of the current LCR until the PWS has achieved three rounds of monitoring results under the lead AL using the current LCR requirements. Results from past rounds of monitoring can be used or new data will be required if prior year data is above the AL. At that point, the PWS can define their CCT or WQPs for the new rule as that which was used to achieve this record. The existing lead AL should be redefined as a System Action Level in the new rule wherein it will be used when determining re-optimization, e.g. for use during a review of a new source or treatment. If the state determines that a round of tap sampling is warranted, In other words, it will provide a baseline target for confirming CCT if lead sampling is chosen as one means by which to determine CCT. PWSs must continue to demonstrate that they are maintaining the WQPs used to establish the transitions.

Commented [GB2]: NEW - This paragraph is identical to the paragraph in the comment field in the previous draft with the addition of the final sentence, which was implied.

Insert a transition recommendation

3.4.1 Water Quality Parameter Monitoring

As noted above, WQP monitoring is distinguished from the more extensive list of parameters that a water system would consider as it evaluates corrosion control technology choices. WQPs for the purpose of this section involve the on-going process control monitoring that demonstrates that the selected treatment is being properly operated over time.

The WQP program recommended below builds on what is in the current rule by recommending:

1) more frequent monitoring than present and monitoring that is better distributed through out the distribution system (e.g. at points currently used for DBP monitoring or at a subset of points used for TCR monitoring) to capture currently undetected variability;

Commented [GB3]: Check what the current rule requires about sampling locations, i.e. is this the same or broader geographic distribution?

2) continuing to tailor WQPs to the individual PWS CCT plan and asking EPA to review and consider adding to the list of WQPs referenced in the LCR, based on EPA's anticipated revision to the CCT guidance manual;

3) that WQP monitoring be periodically revisited based on the advancing science as documented in research reports and disseminated through periodically revised EPA guidance manuals; and

4) that a more rigorous data review process such as control charting and similar process control techniques be used to take advantage of the collected data to improve the consistency of operation, encourage fine-tuning of processes, reduce variability of water quality within the distribution system and detect and manage excursions.

In addition, this data should be reviewed whenever there is a change in source or treatment (see 4.3 above); and, when a system or state primacy agency sees significant changes in WQP data, it should initiate a "find and fix" process, looking for what changed and why, and requiring the PWS make any needed adjustments or corrections. This provides one type of reality check and correction not explicitly in the current LCR.

In addition, the LCRWG recommends that systems which are not currently practicing CCT under the LCR but have been under the lead action level by virtue of either naturally non-aggressive source water or by virtue of other aspects of treatment in use, be required to conduct a WQP monitoring program to continue to demonstrate that the characteristics which caused them to be non-corrosive are continuing to be in place.

3.4.2 Tap Sampling for Lead

The LCRWG also recommends that a voluntary customer-initiated sampling program based on the more robust and targeted public education efforts being recommended elsewhere in this report be substituted for the current LCR tap sampling requirements. ~~Revisions to the LCR should require that outreach to the general public, households with lead services, and vulnerable populations such as pregnant women and households with young children offer free lead sampling of tap water.~~

The results of the voluntary tap sampling program will be used for three separate purposes:

- informing and empowering individual households to take action to reduce risk,
- reporting to health officials when monitoring results exceed a "household action level" (see section 3.5) and
- ongoing information to the utility to assess effectiveness of CCT.

Information for Households

Data from customer-initiated sampling will be valuable in informing and empowering individual households and thus provide greater customer service. All data provided to customers would need to include appropriate information about the variability of lead levels, that a single sample does not represent all water quality, and that levels at a particular tap at a particular time might be higher or lower. The transmittal should also provide appropriate information about the risks of lead exposure, sensitive populations, and actions the consumer can take to minimize risk.

This type of sampling is currently discouraged by the current rule because water systems are often concerned that "complaint" or "customer " samples would be included into the required 90th percentile calculation with potential mandatory response actions if it exceeded the action level. This resulted in system not offering sampling or having the samples be analyzed through a private lab (and therefore the data would not be available for any utility management or regulatory purpose). Currently, PWSs are

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mandated to return to the same locations which, while it may have value for other reasons, means that many other households do not get the opportunity to understand their lead exposure. Voluntary customer-initiated sampling can also capture data from multi-family residences, which is not included in the mandatory LCR sampling in most cases. A new approach could achieve greater customer service and more data to understand and manage lead corrosion.

Outreach to encourage customers to sample will likely involve many different customer contact opportunities including the CCR, outreach related to having a LSL, outreach related to construction contracts, community meetings, other educational outreach efforts, and whenever a customer contacts the CWS for a water quality question or complaint.

Customers should be given the opportunity to determine the type of information they are interested in, thus should be offered a menu of samples types, e.g. a random daytime sample to determine typical exposure levels, first draw to determine the effects of a brass faucet, or a timed or temperature determined sample from within a service line. The National Clearinghouse should include templates with instructions for each type of sample.

Information for Public Health Officials

Data from customer samples which exceeded the "household action level" recommended in section 3.5, would be required to be forwarded to health officials. While LCR tap water results are currently provided to the collecting household, the LCR does not require any action for individual high samples, and there is no mandate to refer to health authorities. While the LCR cannot guarantee actions by health departments, this recommendation provides direct health intervention in those cases where sampling indicates high lead levels.

Information for Assessing the Effectiveness of CCT

The third use of the customer tap sampling data is to provide on-going information to the utility of potential changes in the effectiveness of CCT. Under the current rule, most systems are sampling for one four-month period every three years. Any changes or variability in lead levels at the tap during the other 32 months of that period are missed. Under this proposal, it is anticipated that there would be a more regular stream of data from more locations, providing information which can be used to understand system performance. The data would be provided to the state primacy agency and presented as time series data to facilitate identifying any changes in the data over time. Small systems might report the data on something as simple as a spreadsheet chart, while larger systems might use more sophisticated analytical methods to understand and use the data.

Unexpected or unexplained changes in the tap sampling data can be used in a "find and fix" approach to identify and respond to potential problems. This could be system initiated or in response to periodic review of the system data by the primacy agency, such as during a sanitary survey. This provides a reality check on whether something unexpected is happening within the distribution system, even though consistent treatment was maintained. The more robust (in both temporal and geographic distribution) of the customer sample data set provides a more powerful check on treatment than the current episodic sampling does.

Specifically the LCRWG recommends that the revised rule require that:

- any customer sampling data be reported to the state on a routine basis;
- data be provided as soon as possible and no later than within 30 days to the customer and, if over the household action level, to the health department (as discussed above and in section 3.5);

Commented [I4]: JAS: Laboratory holding time for a lead sample can be quite long, and often exceed 30 days.

- the PWS maintain the data set for analysis and review, taking type and location of each sample into consideration, to identify trends and changes in the data;
- the data be available for public review as described in section 3.2.4;
- the PWS and the state review the data and trend analysis during sanitary surveys;
- annually, at the discretion of the primacy agency, the PWS provide the primacy agency with a data summary report of the three most recent years of all tap sampling data, the specific details of which should be determined by EPA;
- if the three most recent years of customer sampling data show that the 90th percentile (running three-year calculation) is above the System Action Level, then the PWS must analyze any changes or trends in the data to evaluate whether they are based on system-wide, local , or household-based conditions, and provide the report and analysis to the state for their review and determination if additional analysis, re-evaluation of CCT, or other actions such as household-based actions (LSL removal, education about lead-free faucets, and flushing after non-use of water, etc) are appropriate..
- if the system makes any source or treatment changes, the PWS and state should use the customer sampling data in the consultation, review and approval by the State currently required by the LCR.

The LCRWG also recommends that EPA provide guidance to states and PWSs on additional forms and types of data analyses which can be conducted on sampling data to provide more detailed understanding of trends and to support system decision making on customer actions, treatment evaluations or development of system plans and priorities for LSL replacement programs.

It seems appropriate to include some sort of floor to the number of customer samples. Some members of the group suggested that systems should be required to collect no fewer samples in a three year period than they would under the current three-year reduced monitoring requirement.

When a system changes its source or treatment, and is required to consult with the state, the state primacy agency also may choose to require additional one-time monitoring to evaluate those changes if the degree of the change warrants.

Some members suggested that some small systems might want the opportunity to maintain the current home tap water monitoring program. The revised LCR should allow this, while not discouraging customer sampling.

3.4.3 Sample Invalidation Criteria

Under the existing regulation (141.86 (f)(1)), "The State may invalidate a lead or copper tap water sample if at least one of the following conditions is met.

(i) The laboratory establishes that improper sample analysis caused erroneous results.
(ii) The State determines that the sample was taken from a site that did not meet the site selection criteria of this section.
(iii) The sample container was damaged in transit.
(iv) There is substantial reason to believe that the sample was subject to tampering."

These are all good and necessary reasons for invalidating a sample and should be retained, but because this list is limited, samples must be accepted that are obvious "outliers" and don't represent the water that is normally consumed and should not be used as a basis for treatment changes or public education. This is especially true for small systems where the limited number of samples required means that a single, unusually high, value can cause the Action Level to be exceeded. This could lead to installation of

Commented [I5]: JAS: The state would need to know the sampling protocol for each sample if more than one protocol is used.

Commented [GB6]: This insert was drafted during the last meeting and then discussed further on day two. The last two bullets are a subsequent clarification (combining the three bullets below), based on questions raised at the meeting.

- if the annual report on customer sampling data shows that the 90th percentile is above the SAL, then the PWS must evaluate the data in order to understand any changes or trends in the data;
- that evaluation report is to be provided to the state for their review and determination if additional analysis or other actions are appropriate; and
- the PWS and state to review the customer sampling data in any review of source or treatment changes.

Commented [GB7]: What is the role of sample invalidation criteria if these recommendations are adopted?

Steve Estes-Smargiasi suggests:

The invalidation criteria will continue to be needed during the transition period as systems determine if their prior three rounds of samples are below the AL, and may be needed if states require tap water sampling as part of the assessment prior to or after a new source or new treatment process is put into place

Gary Burlingame suggests that once the PWS transitions to the new rule construct, this would no longer need to apply.

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expensive treatment when treatment is not needed or adequate corrosion control is already being provided. While probably not as frequent, non-representative samples could also cause water systems to be below the action level when treatment changes really are needed. Good invalidation criteria can help states address both problems.

The purpose of the invalidation is to make sure that decisions are based on the most representative set of samples possible and to do so through a process that provides adequate information to make good invalidation decisions and assures documentation of the reasoning behind the invalidation.

The following is a proposal from states that will serve those two functions.

States believe that the essential criteria for invalidation are already well stated in the [HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/upload/Revised-Lead-and-Copper-Rule-Monitoring-and-Reporting-Guidance-for-Public-Water-Systems.pdf"] or the October 2006 memorandum on [HYPERLINK "http://water.epa.gov/lawsregs/guidance/sdwa/upload/wsg_178.pdf"]. The language in these documents is consistent with the sampling requirements in 141.86 (b).

- "Always collect a first-draw sample from a tap where the water has stood in the pipes for at least six hours (e.g., no flushing, showering, etc.). However, make sure it is a tap that is used regularly, and not an abandoned or infrequently used tap."
- "First-draw samples collected at single-family residences must always be drawn from the cold-water kitchen tap or bathroom tap."
- "First-draw samples collected from buildings other than single-family homes must always be drawn from an interior tap from which water is typically taken for consumption."
- "Therefore, public water systems should not recommend that customers remove or clean aerators prior to or during the collection of tap samples for lead."

Commented [GB8]: Derrick/June – What would you think about the following:
1. deleting the first bullet for consistency with the group's recommendation that customer requested samples could be taken with different protocols depending on the customer's reason for the request.
2. Making the second and third bullets "if/then" statements.
3. Keeping the forth bullet but deleting "therefore"

Commented [I9]: JAS: I think that if samples are taken using a wide variety of protocols then it will be difficult for the data to serve the "reality check" function that we discussed. If it is limited to a two or three clearly defined protocols such as random daytime, first draw and LSL, I could see that being workable. I have no issue with edits 2 and 3.

3.4.4. Monitoring Compliance

PCWS must monitor and report based on water quality parameters and schedule set by state primacy agency, and use the data for on-going treatment process control (3.4.1)

Violations:
- Failure to monitor as per schedule
- Failure to maintain data, and use in process monitoring (to be evaluated by state during sanitary survey inspections or as state primacy agency requests)
- Failure to report data to state
- Monitoring results outside the WQP range established in the PWSs CCT plan along lines similar to current rule requirements

PCWS also must include an offer to customers in all LCR related outreach to conduct a sample, including in all LSL outreach efforts. PCWS must also:

- collect sufficient number of samples, either by customer request or utility initiated sampling, i.e. no fewer samples in a three year period than under the current three-year reduced monitoring requirement, assuming the PCWS qualifies for such reduced monitoring;
- promptly report the data to the customer, the state and local PH (if above health action level); and
- use the data as part of on-going evaluation of CCT performance, monitoring for changes in lead levels at the tap over time, geographic trends in levels, and interaction with distribution system water quality.

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Violations:

- Failure to offer to sample
- Failure to collect minimum number of required samples within 3-year window
- Failure to report data to:
  - Household
  - State
  - Local public health agency (if above household action level) as soon as possible but no later than 30 days after the result was received
- Failure to provide rule-required information in sampling offer materials, or in household reporting of the data
- Failure to use household tap sampling data in on-going evaluation of CCT and maintain record of having done so, (as determined by state during sanitary survey inspections or as state primacy agency requests)

3.5 Establish a Household Action Level

The current lead action level is based on the 90th percentile of the collected samples. Without a maximum limit, some users may be exposed to levels of lead in the drinking water that presents a potentially significant health threat, especially to children, without exceeding the action level.[10] If the levels are high enough and state and local authorities do not act, EPA could determine that the levels pose "an imminent and substantial endangerment to the health of persons" pursuant to section 1431 of the Safe Drinking Water Act. (40 USC 300i)

3.5.1 Household Action Level Recommendations

To avoid the possible need to invoke section 1431 of the SDWA, the LCRWG recommends that EPA establish in a revised rule a "household action level" and require the PWS to notify the local health department and state drinking water authority of sample results over that level. The requirement would be triggered by any sample results that the PWS receives from a user or from its own monitoring. However, the PWS would not be required to make the notification until it has investigated the sample in a timely manner to eliminate sampling or assay errors.

The existing rule already requires the PWS to notify residents of the results of water system conducted lead sampling. We would anticipate that the PWS would alert the resident to possibility that the health department may be notified when the sample was taken or the resident provided the PWS with the sample results. While this notice may have the unintended consequence of discouraging some customers from testing, it is important for the customer to make an informed choice.

In response to the notification, the PWS and the health department would consider the situation and take action that they deem appropriate (e.g., testing children's blood, recommending a filter, discussing lead service line replacement with the resident or landlord, advising grandparents

[10] The LCRWG discussed the relationship between the household action level and the current lead AL (to be renamed the system action level) and recognizes that, depending on what level is set, the household action level may have impacts on other recommendations in this report.

about risk to visiting children, or continuing to monitor the situation). We anticipate that the health department be the lead agency, and that the rule would not prescribe actions other than notice as the situations are too diverse and complicated for prescription actions. The LCRWG encourages EPA to work with the Centers for Disease Control and Prevention on recommended approaches and make this information available through the clearinghouse discussed in section 4.2.

This requirement would be somewhat similar to the regulatory approach taken by the Department of Housing and Urban Development which mandates that public housing authorities notify the local health department within five days when it receives information from any source that a child of less than six years of age living in an assisted dwelling unit may have an environmental intervention blood lead level. (24 CFR 35.1225)

We recommend that EPA set the household action level based on the amount it would take for an infant to have a blood lead level greater than five micrograms per deciliter (µg/dL) based on consumption of infant formula made with water. When a child's blood lead level exceeds five µg/dL, the Centers for Disease Control and Prevention (CDC) recommends that laboratories and health care providers notify local and state health departments and that action be taken to identify and prevent further exposure.[11] ~~While unlikely, if the calculation shows that the household action level is lower than the system action level, EPA would need to reassess the approach.~~

3.5.2 Household Action Level Compliance

If household sample exceeds the household action level, PWS must promptly notify the household and the local public health agency; certify that this has been done, and maintain records of having done so.

Violations:

- Failure to ~~timely~~ report data ~~as soon as possible~~ and no later than 30 days after receiving ~~the results~~ to
  - Household
  - Local public health agency
- Failure to certify to state that ~~this has been done~~data was reported to the household and to ~~the local public health agency within 30 days~~
- Failure to maintain records of correspondence between PWS and ~~the local public health agency PH~~

Commented [GB10]: NEW – are some of these redundant?

Commented [I11]: JAS: States should not be expected to conduct record review at the water system to establish compliance, this is too time consuming. To be practical, the certification of compliance should contain summary data. Also, "as soon as possible" is not enforceable. The violation should simply be failure to report data within 30 days of receipt.

3.6 Establish Separate Monitoring Requirements for Copper

The current LCR does not deal effectively with copper. Generally speaking, the current rule focuses on the health benefits associated with lead risk reduction, with the result that the currently required in-home sampling is often done in locations with old copper that has passivated. Thus, the possibility may be missed that a system's water chemistry could result in copper releases. Further, the current rule does not require public education for copper, which can have broad benefits.

[11] http://www.cdc.gov/nceh/lead/ACCLPP/blood_lead_levels.htm

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The LCRWG has concluded that the regulatory approach should separate lead and copper risk management, refocusing attention to where there may be a problem with copper without increasing the burden on systems where there is not a problem. This can be achieved in a cost effective manner by targeting copper monitoring requirements to those PWSs where there may be exposures.

Elevated exposures to copper generally result from new copper plumbing[12] where water chemistry is aggressive to copper. It is technically possible to identify water chemistries that are aggressive versus not aggressive to copper. Thus, the LCRWG recommends that the requirements for copper monitoring focus first on sampling for basic finished water quality parameters such as pH and alkalinity in a way that is representative of the distribution system to identify waters that are aggressive to copper. Systems that can demonstrate that their finished waters are not aggressive to copper or that their distribution systems contain no copper should have no further copper monitoring requirements. This could be written into the rule, rather than require a monitoring "waiver."

3.6.1 Copper Recommendations

Further, the LCRWG recommends that the LCR be revised based on the following concepts:

1. Instead of basing action on the results of routine, in-home copper sampling, actions should be based on the aggressiveness of the water to copper. Systems can determine if their water is aggressive to copper by doing WQP monitoring in the distribution system. All PWSs should be assumed to have water that is aggressive to copper unless they demonstrate that it isn't.

2. EPA should develop criteria to define water that is not aggressive to copper for the purpose of establishing whether a system falls into that category (or "bin") for the purposes of the LCR. EPA should consider the accuracy and potential variability of pH and alkalinity monitoring as well as corrosivity to copper in establishing pH and alkalinity ranges. The criteria also should include consideration of passivation time. Examples of bins (for verification by EPA) would be:

    a. if alkalinity is < 35 pH must be > 7.0 (no upper pH limit)
    b. if alkalinity is 36 to 100, pH must be > 7.2
    c. if alkalinity is 101 to 150 , pH must be > 7.5
    d. if alkalinity is 151-250 , pH must be > 8

If orthophosphate is used, examples of bins would be:

    a. if alkalinity <150, PO4 must be >1 mg/L
    b. if alkalinity is 150 to 200, PO4 must be > 2 mg/L
    c. if alkalinity is 200 to 240, PO4 must be > 3 mg/L
    d. if alkalinity is greater than 240, PO4 must be > 3.3 mg/L

3. PWSs can choose one of several approaches to demonstrate that their water is not aggressive to copper:

    a. Conduct water quality parameter monitoring to assess whether their water meets the definition established by EPA.

[12] New copper is generally understood to be up to six months to three years of age.

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b. Conduct a one-time evaluation with copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL). EPA may want to consider:

i. Limited number of sample sites needed given copper chemistry

ii. Provision for sample invalidation based on site-specific conditions such as biologically-induced corrosion.

c. Conduct a pipe loop study to demonstrate the water chemistry is non-aggressive

d. Change water chemistry to within the range established for non-aggressive water quality

4. PWSs with water **classified as non-aggressive to copper** must continue to demonstrate that the water is non-aggressive. PWS's can choose to:

a. Maintain those WQPs that demonstrate it maintains non-aggressive water under (2) above, or

b. Conduct copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL)

PWSs that are not able to maintain their WQPs must implement a public education program as described in the next section.

5. PWS's with water **classified as aggressive to copper** must initiate and maintain a public education program. The public education program must either provide:

a. Information to all new homes (new construction or change of service) upon initiation of new service

AND

b.

i. Information to newly renovated homes at time of renovation

OR

ii. Information to all customers on a routine basis

In addition, in guidance, EPA should encourage PWSs to notify contractors, plumbing suppliers, and plumbers of copper corrosivity and to work with relevant officials and organizations to consider building and plumbing code changes that would prohibit copper piping in new construction if the corrosive water conditions cannot be eliminated. EPA also should provide guidance and/or templates, particularly for small systems, for public education messages and modes of delivery.

6. EPA should consider whether or under what circumstances CCT should be required for a PWS **classified as aggressive to copper** Not all systems with water aggressive to copper necessarily will have homes with new copper, so treatment might not be necessary or perhaps even advisable, particularly for small systems that can control plumbing materials used or for systems in communities that modify their plumbing codes. Passivation time of copper varies considerably, and CCT may not be necessary or advisable when passivation time is short if interim actions to protect public health other than CCT are feasible. In determining when CCT should be required and any associated monitoring requirements, EPA also should take into consideration that a PWS may not have access to information about renovations where new copper has been installed and, even when such information is available, can't control whether the customer will participate in a

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monitoring program. Setting the correct level and establishing a regulatory approach that triggers CCT only when necessary will require a complex assessment and is beyond the scope of this workgroup. ~~but the LCRWG does not contemplate this leading to a large percentage of systems with water aggressive to copper having to install treatment.~~

7. In the revised LCR, systems should continue to be required to notify the primacy agency if they are making any long-term treatment change or addition of a new source. This section of the rule should be made clear that for copper, the system may be required to demonstrate that its finished water continues to be non-aggressive to copper (per 4 above).

8. Additional information needs to be gathered on the current distribution of pH, alkalinity, and phosphate residual among systems nationally to fully understand the implications of this approach.

3.6.2 Copper Compliance

Violations:

- Failure to implement public education, for PWSs that have not demonstrated their water chemistry is not aggressive to copper.
- Failure to maintain a monitoring program representative of the distribution system that demonstrates the system has water chemistry not aggressive to copper.
- Failure to provide notice to and, if required, consultation with the primacy agency, when a PWS makes a significant change in source or treatment (as in the current LCR).
- Failure to implement CCT or other risk reduction actions prior to CCT as determined by the primacy agency.

4 Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water

The LCRWG urges EPA not only to promulgate a revised LCR, but also to play a leadership role in educating, motivating, and supporting the work of other agencies, where EPA does not have the authority to act. The ~~Long-Term Revisions to the Lead and Copper Rule (~~LTR LCR~~) are~~is very important. However, removing lead from drinking water systems and reducing exposure to lead from drinking water in the meantime will require renewed commitment, cooperation and effort by government at all levels and by the general public.

Specific recommendations for action in addition to the LTR LCR include (in no particular order): ~~*[Note: These items are taken from a variety of sources, are in no particular order.]*~~

- EPA working across all offices to take an integrated approach to action and education on lead from all sources (paint, air, site clean–up, etc.), with proper emphasis on lead in drinking water, especially in relation to the populations most vulnerable to this source (pregnant women, infants and young children~~i.e., fetuses and infants dependent on reconstituted formula~~). For example, OGWDW should coordinate with EPA's lead-based paint program so lead hazards are communicated consistently.

- Work with other federal agencies including HUD in terms of lead programs, including but not limited to expanding federal funding from those programs to include lead service line replacement; HUD/DOT in terms of efficiency in possible coordination of lead service line

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replacement with road projects and other construction projects; and CDC in terms of childhood lead poisoning prevention, screening, and protection programs

- Enhanced cooperation with state, county, local health departments to promote an integrated approach to childhood lead poisoning screening, prevention, and protection that emphasizes drinking water and its potential as a primary lead source (e.g. ~~especially for fetuses and~~ infants dependent on reconstituted formula).

- EPA needs to work with agencies at all levels of government to support financial assistance programs for LSL removal. Building costs into a PWS's capital budget planning should also be a consideration.

- EPA should include diverse perspectives in its stakeholder engagement programs, including affected consumers (who should not be required to be members of formal organizations), lead poisoning prevention/clean water advocates, EJ advocates, lead/copper corrosion experts, and representatives from PWSs, States, and federal agencies with Healthy Homes and childhood lead poisoning prevention programs.

- Local or state building and plumbing codes, including possibility of prohibiting copper plumbing where water is aggressive to copper.

- A federal tax deduction to support replacement of the customer portion of LSLs.

- State Actions to support customer lead service line replacement, e.g.
    - State legislation requiring inspection or replacement on sale of home
    - Disclosure requirements at sale of home
    - Requirements for LSL removal as part of school and day care licensing
    - Building code requirements for LSL removal upon substantial renovation (could be national action as well)
    - Priority in DWSRF funding, (especially if increased funding is available. (Criteria states might wish to consider include PWSs where there is a high incidence of elevated BLLs for children, a high percentage of homes with LSLs, a high percentage of low income families, the PWSs prior efforts to replace LSLs, etc)[13]

- ~~Financial assistance and affordability o~~Options EPA may want to describe in guidance and PWSs could consider include but are not limited to:
    e. Rate design considerations:
        i. Low rates for low volumes
        ii. Household size-based rates
    f. Non-rate policies
        i. Budget billing
        ii. Fixture retrofits and plumbing assistance by the PWS
        iii. Service line replacement and insurance programs not provided by PWS
        iv. Direct assistance, emergency bill payment relationships
        v. Fixture retrofits and plumbing assistance by NGO organizations providing affordable housing

[13] The State of Massachusetts has a program that could serve as a good model, including providing loans to property owners using DWSRF funds in which payment of the loan is deferred until the sale or refinancing of the property.

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vi. Subsidies including LSL / connection replacement costs associated with street, sidewalk, and other repairs not related to drinking water infrastructure
vii. On-bill financing provided by the PWS

g. Funding guidance
   i. EPA's Financing for Environmental Compliance – Water
   ii. Tools for Financing Water Infrastructure

h. Funding sources beyond rate revenue:
   i. EPA's Drinking Water State Revolving Fund (DWSLF)
   ii. USDA's Water and Environmental Programs, U.S. Department of Agriculture, Rural Development
   iii. HUD's Community Development Block Grant Program – U.S. Department of Housing and Urban Development
   iv. EPA Targeted Grants to Reduce Childhood Lead Poisoning
   v. HUD Healthy Homes Technical Studies
   vi. HUD Office Healthy Homes and Lead Hazard Control Lead Hazard Reduction Demonstration Program
   vii. HUD Health Homes Initiative Lead Elimination Action Program
   viii. HUD Office of Healthy Homes and Lead Hazard Control Lead Hazard Control Lead Technical Studies Grant Program

- PWSs should educate and (encourage partnerships with[2]) healthcare providers and health departments even when levels are below the AL.

- Additional technical review and/or (additional study[2]) is needed on flushing.

- Published, peer reviewed research explaining that water in plumbing systems with leaded materials and LSLs can have sufficient levels of lead in the water to be a risk to those consuming the water. This paper is important to gaining support from the public health agencies and others and to placing water in context with other sources of lead.

- Considering that lead remains a complex issue and that research and information gaps still exist, the EPA should establish a Research and Information Collection Partnership to encourage the filling of these gaps in knowledge. The RICP should be initiated once the EPA begins working on the revised rule and continue for three years or more into the promulgation of the revised rule.

- The EPA and other agencies, such as the Water Research Foundation, should conduct research (such as bench scale and limited system case studies) to confirm the bins selected to define aggressive waters for copper. The bins are based on theory and need some level of confirmation prior to promulgating an actual regulation. This work can be done within the timeframe of developing a final rule.

- EPA should work with CDC and HHS to ensure that the standard protocol for investigation of any child with elevated blood lead levels or of a home with lead levels above the HAL include determination of whether there is a lead service line.

- EPA should work with HHS and HUD to modify funding guidelines for the Healthy Homes and other federal funding programs to explicitly authorize and prioritize the use of those funds for lead service line removal programs targeting the privately owned portion of any lead service line. The current situation of having tens of thousands of dollars spent by a local Healthy Home or lead

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poisoning prevention program to remove lead paint, and leave behind a lead service line because of arbitrary finding guidelines is unacceptable.

- States should consider including requirements for lead in drinking water in state child care licensing rules.

5 Conclusion

The LCRWG appreciates the opportunity to provide these recommendations to the NDWAC, offers our thanks to the experts and members of the public who made presentations to the work group, and wishes particularly to acknowledge EPA for the extensive commitment of staff time and expertise to this process.

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ATTACHMENT A

NDWAC Lead and Copper Working Group

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Leon Bethune: Director, Director of Office of Environmental Health, Boston Public Health Commission
Gary Burlingame: Laboratory Director, Philadelphia Water Department
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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
Yanna Lambrinidou: Parents for Non-toxic Alternatives
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June Swallow: Chief, Division of Water Quality, Rhode Island Department of Health
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Table 1: Elements of utility reports by dates in three-year cycle (*based on EPA adoption of rule in 2017)

Action	2020*	2023	2026	2029	2032	2035	2038	2041	2044	2047	2050
Confirm broad and targeted education programs underway[1]	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.
Status of consumer sampling[2]	NA	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered	# done & # offered
Confirm communication of sampling results[3]	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.
Confirm operation policies in place[4]	Yes. If not, then explain	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.	Yes. If not, then explain.
Replacement Progress[5]	InitialBaseline	85% remaining	70% remaining	55% remaining	40% remaining	25% remaining	17% remaining	10% remaining	6% remaining	3% remaining	0% remaining
If replacement goals not met, number of checklist items confirmed completed (See Table 2)[6]	Basic requirements *[see Section 3.1.2]*	Basic requirements	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)	TBD (by EPA)

[1] See Section 3.1.2 (item 4 "targeted outreach" EPA to provide a checklist; PWS to contact customers with LSLs individually at least every three years and when there is a new customer at that address.

[2] Number of customers offered opportunity to conduct at-tap samples and number of samples taken.

Confirmation that results were provided to the customer. Number exceeding the household action level and confirmation that the results were submitted to health department. Maintain records for review by the primacy agency.

[4] Program to ensure that emergency, maintenance and renovation operations consider risks of disruption to service line increasing lead exposure to residents. See Section 3.1.2 item 7 (operations).

[5] A service line is presumed lead unless installed after date installation of lead service line prohibited or records or tests by utility confirm entire service line is not lead. Confirming that a service line is not lead counts toward replacement progress.

[6] This is a two-fold concept, the details of which the LCRWG suggests be determined by EPA: 1) provide the PWS the flexibility to select outreach methods and other efforts appropriate to that community and 2) increase the number of required efforts~~outreach methods~~ to be completed if replacement goals are not met. See Table 2 for checklist of options for additional effort (in addition to the basic outreach requirements).

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Table 2 ~~Checklist of~~ Options (in addition to the basic outreach requirements) to be accomplished by utility if replacement progress goals in Table 1 not met.[1]

Basic outreach requirements:

- Individually notify~~Contact~~ customers with known or possible LSLs describing the risks of lead in drinking water, specifically inviting them to participate in the LSLR program, offering to have the customer's tap water analyzed, and clearly describing the terms of the program and how to follow up. If the customer does not respond or chooses not to participate, the PWS must follow up with another invitation at least every three years and always when there is a new customer at that address. ~~individually at least every three years and where there is a new customer at that address, with information about the risks associated with LSLs, an offer to replace the LSL with the financial terms available, and an offer to do tap sampling~~ (see Section 3.1.2 for additional details)
- Provide a written offer to replace the LSL when work is being done on the water main in the street (with the same information above).

Resident engagement	System policies	Other
1. Notice to new customers of need	1. Plumbing code requires full replacement if service line will be disturbed.	1. Local health agency contact with resident.
2. Written offer to replace when main in street rehabbed (customer pays)	2. Grants or low-interest loan funds identified to cover customer costs sufficient to maintain progress for period.	2. Local health agency funding for removal as part of remediation
3. Written offer to volunteer (customer pays)	3. Financing options such as liens on home provided to customers or tax deductions for property owner costs.	3. Media campaign launched
4. Written refusal from customer(s)	4. MOU or other arrangement to implement notification of customers/property owners by other utilities about replacement options if LSL is disturbed	4. Homeowner association(s) send letters to members supporting replacement.
5. Certified letters sent	5. Capital improvement plans target system pipe rehab and replacement to areas with more LSLs	5. Real estate organizations notified of requirement for replacement of LSL on sale or transfer of title
6. In-person call or visit made	6. Service line insurance program revised to include replacement LSLs if damaged or leaking	6. Cooperative outreach efforts with non-profits
7.	7. More aggressive flushing in areas with LSLs to manage iron related lead particles	7. Coordinated outreach with WIC
8.	8.	8. Outreach to plumbers/contractors
9.	9.	9. Outreach to ob/gyns and pediatricians
10.	10.	10. Local ordinance requiring inspection/notification/replacement of LSLs upon sale or transfer of title
11.	11.	11. LSL identification added to home inspector standard operating procedures

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12.	12.	12.
[1] EPA will provide guidance on the options and update them periodically as best practices evolve.		

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Message

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Sent: 8/14/2014 5:45:24 PM
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Subject: NDWAC LCR Work Group: Public Education Primer
Attachments: Final Public Education Primer (8-14-14).pdf

Good Afternoon,
Attached is the Public Education Primer in preparation for next week's webinar and September's discussion on public education.

Best,

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Public Education Primer

8/11/14

I. Regulatory History

When the Lead and Copper Rule (LCR) was promulgated in 1991, implementation of a public education (PE) program was established as a requirement when a water system exceeds the lead action level. The purpose of the public education program is to notify water system customers of the elevated levels of lead in drinking water, advise customers of the actions the system is taking to reduce lead levels, and prevent known or anticipated adverse health effects by providing information on ways consumers may reduce their exposure. The 1991 LCR did not include copper public education requirements.

In 2004, EPA began a wide-ranging review of the LCR with the intent of identifying areas of the rule that needed updating and improvement. During this national review, EPA identified public education as a topic for discussion with stakeholders. In September of 2004, EPA held a Public Education Expert Workshop with representatives from water utilities, State primacy agencies, the Centers for Disease Control and Prevention, and non-governmental organizations. The purpose of the workshop was to discuss public education requirements under the LCR, drinking water risk communication, and effective communication with the public. Some stakeholders at the workshop stated that the mandatory PE language in the rule was too long, cumbersome, and complex.

In June of 2005, EPA's National Drinking Water Advisory Council (NDWAC) voted on and approved the formation of a Working Group on Public Education (WGPE) to provide recommendations on the public education requirements of the LCR. EPA selected 16 members that represented utilities; consumers; regulators; public health organizations; and risk communication experts. Four members of the NDWAC served on the working group to facilitate the flow of information between the two groups. The charge for the WGPE was to (1) review the current public education requirements on lead in drinking water to identify and define the need for improvements and to provide input to the NDWAC; (2) develop language for communicating the risk of lead in drinking water and a suggested response to the public; and (3) define the delivery means to the public. In June of 2006 the working group presented a report summarizing its input to the NDWAC; the NDWAC then provided recommendations to the EPA Administrator.

Utilizing the NDWAC's recommendations with some modifications, the EPA promulgated new public education requirements in the 2007 Lead and Copper Rule – Short Term Revisions. The 1991 LCR required the mailing and/or distribution of written materials consisting of over 1,800 words describing health effects, the levels of lead in drinking water, steps to reduce exposure and how to obtain additional information. The written materials required by the 2007 rule are more concise and encourage the public to take appropriate courses of action to reduce their exposure to lead. The 2007 rule requires water systems to target at-risk populations (e.g., children and pregnant women). In addition, a new provision was added that requires water systems to provide the results of lead testing to the persons served by the water system at the site where the sample was collected.

Prior to the 2007 LCR revisions, community water systems (CWS) were required to include an informational statement on its Consumer Confidence Report (CCR) if the lead action level was exceeded in more than 5% and up to 10% of samples. The 2007 rule now requires all CWS to include an informational statement on lead in its CCR every year regardless of lead levels found in sampling.

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II. Public Education Program for Lead

A. Content and Language for Public Education Materials

Water systems exceeding the lead action level must provide public education materials that meet the EPA's mandatory requirements for content and language. Each notice consists of six sections, some of which can be customized: 1) Informational statement; 2) Health effects of lead; 3) Sources of lead (systems are allowed to customize this section); 4) Steps individuals can take to reduce their exposure to lead in their drinking water (systems are allowed to customize this section); 5) What happened and what is being done to correct the problem? (Systems are allowed to customize this section); and 6) Who to call and how to get more information. Community water systems are also required to tell consumers how to get their water tested and discuss lead in plumbing components and the difference between low lead and lead free. Water systems have the flexibility to tailor some educational statements to fit their community's situation, such as providing specific directions on flushing the tap before drinking or using water. For systems that serve a large proportion of non-English speaking consumers (as determined by the primacy agency) the materials must contain information in the appropriate languages regarding the importance of the notice or contain a telephone number or address where persons served may contact the water system to obtain a translated copy of the materials.

B. Delivery Requirements

In general, the delivery of materials must occur within 60-days following the end of the monitoring period in which the action level was exceeded. Delivery must be repeated once every 12 months for as long as the water system exceeds the lead action level. Community water systems are required to deliver public education materials to all bill paying customers. Non-transient, non-community water systems are required to post informational pamphlets and/or brochures in a public place or common area in each of the buildings served by the system and to distribute informational pamphlets and/or brochures to each person served. If water systems have initiated the public education program prior to the 60-day deadline but need more time for delivery, an extension may be given which must be approved in writing by the primacy agency.

As long as the water system exceeds the lead action level, it must provide specified information on or inside each water bill and this type of notification must occur no less than quarterly. The message on the water bill must include the following statement exactly as written except for the text in brackets for which the water system must include system-specific information: **[INSERT NAME OF WATER SYSTEM] found high levels of lead in drinking water in some homes. Lead can cause serious health problems. For more information please call [INSERT NAME OF WATER SYSTEM] [or visit (INSERT YOUR WEB SITE HERE)]**. The message or delivery mechanism can be modified in consultation with the primacy agency. The primacy agency may allow a separate mailing of public education materials to customers if the water system cannot place the information on water bills.

To reach more at-risk populations, EPA requires community water systems to deliver the materials to the following facilities or organizations[1]:

- Local welfare agencies
- Public and private schools or school boards
- Women, Infants and Children (WIC) and Head Start Programs
- Public and private hospitals and medical clinics
- Pediatricians
- Family planning clinics

All community water systems must make a good faith effort[2] to locate the following organizations within the service area and deliver the educational materials along with an informational notice that encourages distribution to all potentially affected customers or users:

- Licensed childcare facilities
- Obstetricians-Gynecologists and Midwives
- Public and private preschools.

In addition to targeting certain facilities or organizations, community water systems are required to conduct activities within the following categories[3]:

- Public Service Announcements
- Paid Advertisements
- Display Information in Public Areas
- Email to Customers
- Public Meetings
- Delivery to Every Household
- Provide Materials Directly to Multi-family Homes
- Other Methods Approved by the Primacy Agency

Educational materials must be posted on a publicly accessible website for all systems that serve greater than 100, 000 individuals. Community water systems must submit a press release[4] to newspaper, television, and radio stations.

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[1] Water systems must deliver these materials to all local public health agencies, even those outside the water system's service area. For systems that serve more than 3,300 people, the materials must be delivered to those facilities or organizations that are located within the service area, along with a cover letter encouraging distribution to all potentially affected customers or users. For systems that serve 3,300 or fewer people, the materials must be delivered to those facilities or organizations that are served by the system and most likely to be visited regularly by pregnant women and children.

[2] The good faith effort to contact at-risk customers may include requesting a specific contact list of the organizations from the local public health agencies, even if the agencies are not located within the water system's service area.

[3] Community water systems that serve 3,300 or fewer customers must conduct one activity from one of the categories. Community water systems that serve more than 3,300 customers must conduct three activities from one, two or three of these categories.

[4] For systems that serve 3,300 or fewer customers, the requirement may be waived by the primacy agency as long as the information is distributed to every household served by the system.

C. Supplemental Monitoring and Customer Notification Requirement

Systems are required to provide the results of lead testing to residents or occupants of sites where samples were taken to compute the system's 90th percentile. The system has no later than 30 days from the time it learns of tap monitoring results to provide the results to the residents/occupants.

When water systems exceed the lead action level, they must offer to test samples for lead for any customer who requests it. The system is not required to collect the sample itself, or pay for the collection or analysis of the sample.

III. Possible Public Education for Copper

A. Introduction

Currently, there are no public education materials or informational statements provided on the health risks of copper exposure, or steps consumers can take to reduce their risk of exposure. The distribution of public education materials for copper could allow consumers to make personal decisions to reduce their exposure to copper based on their individual health needs. EPA is seeking input on whether materials should be provided to consumers to address potential exposures to copper in premise plumbing and identifying the target audience. The Agency is considering requiring copper public education materials for systems exceeding the copper action level and/or a brief informational statement to consumers served by systems which have water quality aggressive to copper.

B. Copper Health Effects

Acute ingestion of excess copper in drinking water is associated with adverse health effects, including acute gastrointestinal (GI) symptoms such as abdominal discomfort, nausea, and vomiting (NRC 2000; USEPA 1991). These symptoms result from the irritant effects of inorganic copper ions on the gastric and intestinal mucosa (NRC 2000; Fukui et al. 1994). For both humans and animals, gastrointestinal symptoms tends to occur within a very short time period after the liquid with elevated copper concentration is consumed, typically within an hour for humans (Wang and Borison 1951; Pizarro et al. 1999; Araya et al. 2001, 2003b; Olivares et al. 2001). The amount of copper in water ingested at one time appears to be of greater importance than the amount of copper consumed over the day (Donohue 1997; NRC 2000). The more copper in the stomach at one time, the more likely GI symptoms will occur in sensitive individuals (Pizarro et al. 1999a; Araya et al. 2001, 2003 a,b,c, 2004; Olivares et al. 2001). GI symptoms have occurred in sensitive individuals from drinking water and other fluids with copper concentrations greater than or equal to 3 mg/L (Pizarro et al. 1999a). In other studies, GI symptoms have also been observed with copper concentrations greater than or equal to 4 mg/L (Araya et al. 2001, 2004; Pizarro et al. 2001; Olivares et al. 2003). Nausea typically occurs at lower copper concentrations than vomiting (Pizarro et al. 1999; Araya et al. 2001, 2004; Olivares et al. 2003). Among individuals who took part in controlled studies of exposure to 4 mg/L copper in about 7 fluid ounces of solution, less than 10% experienced nausea, indicating a range of sensitivity in the population (Araya et al. 2001; Olivares et al. 2001). Subject response was variable with the same subject having a positive response during one test episode but failing to confirm the response when given the same dose on a separate occasion (Olivares et al., 2001). In the Olivares et al. (2001) study about 76% of those tested confirmed their threshold;

confirmation was more likely at the higher copper doses than at the lower doses. A controlled, household-based, population study (Araya et al., 2004) suggests adaptation to the low concentrations of copper (range 4-6 mg/L) with an increased duration of exposure. Human gastrointestinal response to copper in water can be influenced by individual sensitivity, acclimatization, the amount of solution ingested per exposure, and the presence or absence of copper-binding food materials in the stomach. These confounding factors make it difficult to adequately determine the minimum dose that causes an acute gastrointestinal response (Donohue 1997).

While, for the majority of the population, the GI symptoms are not severe or life-threatening, chronic ingestion of copper can lead to liver toxicity and/or effects on the nervous system in sensitive populations such as those with Wilson's disease or one of the rare, often fatal, infant idiopathic copper toxicosis (NRC 2000). Copper drinking-water concentrations of approximately 3 mg/L and greater have been associated with some cases of idiopathic copper toxicosis, suggesting that levels above the copper MCLG of 1.3 mg/L might cause an increase in liver problems in genetically susceptible populations (NRC 2000). For this reason, in 2000, the NRC recommended that the copper MCLG not be increased.

Infants may be sensitive to elevated copper in water for both exposure and genetic reasons. Infants fed formula prepared with tap water consume a higher amount of tap water on a per body weight basis than adults (NRC 2000; Knobeloch et al. 1994). Infants also have a reduced capacity to excrete copper relative to older individuals, which increases their copper retention (NRC 2000). Controlled studies investigating infants did not show any significant increase in gastrointestinal symptoms at 2.0 mg/L copper concentration (Olivares et al. 1998). Cases of 3severe liver cirrhosis in infants resulting from elevated copper in drinking water, formula or milk, appear to have a genetic basis which contributes to their sensitivity (NRC 2000). The NRC (2000) commented that while the available data were plagued by imprecise exposure measurements, there was some indication that sensitive infants might be at risk for liver toxicity at copper concentrations of approximately 3 mg/L of drinking water (NRC 2000). It is challenging to link illnesses directly to individual copper exposures. Likewise, there is a range of sensitivity within the population (NRC 2000), meaning various individuals can experience differing physiological responses to copper exposure. In reviewing the scientific literature, the Agency identified two U. S. studies (Knobeloch et al. 1998, Spitalny et al. 1984) that demonstrated a gastric response such as nausea, or vomiting after exposure to drinking water from the tap with elevated copper levels (children and adults). In all of these examples, water quality was found to be aggressive to copper.

C. *Options for a Public Education Program for Copper*

The Agency is considering requiring copper public education materials for systems exceeding the copper action level and/or a brief informational statement to consumers served by systems with water quality aggressive to copper. Public education materials may be delivered to all consumers when the public water system exceeds the copper action level. The content and mechanism of delivery could be similar to the way consumers are educated about lead after a lead action level exceedance. Informational statements refers to educational materials that could be delivered to consumers when systems have water quality that is aggressive to copper, it would not be based on exceeding the copper action level.

Public Education Primer

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The following are elements EPA is considering for a public education requirement for copper in the event of a copper action level exceedance:

(1) An explanation of what copper is, the possible sources of copper in drinking water and how copper enters drinking water;
(2) An explanation of copper health effects;
(3) Steps consumer can take to reduce their exposure to copper in drinking water;
(4) An explanation of why there are elevated levels of copper in the system's drinking water (if known) and what the water system is doing to reduce the copper levels in homes/buildings in the area
(5) A description of the likelihood of copper leaching from copper pipes in homes/buildings in the area.
(6) An explanation of what other plumbing materials are available for use in areas where the water quality is aggressive to copper.

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Message

From: Gail Bingham [gbingham@resolv.org]
Sent: 5/25/2015 7:22:17 PM
To: Bell, Aaron L. [Bell.Aaron@epa.gov]; Clement, Robert [Clement.Robert@epa.gov]; Damico, Brian [Damico.Brian@epa.gov]; Smith, Brian [Smith.Brian@epa.gov]; Cantilli, Robert [Cantilli.Robert@epa.gov]; Darman, Leslie [Darman.Leslie@epa.gov]; Adams, Darryl [Adams.Darryl@epa.gov]; DeMarco.Carol@epamail.epa.gov; Guignet, Dennis [Guignet.Dennis@epa.gov]; Kwong, Ellie [kwong.ellie@epa.gov]; Ellis, Jerry [Ellis.Jerry@epa.gov]; Erickson, Dana [Erickson.Dana@epa.gov]; Palagian, Evangelia [Palagian.Evangelia@epa.gov]; Rizzo, George [Rizzo.George@epa.gov]; Farber, Glenn [Farber.Glenn@epa.gov]; Helm, Erik [Helm.Erik@epa.gov]; Gambatese, Jason [Gambatese.Jason@epa.gov]; Donohue, Joyce [Donohue.Joyce@epa.gov]; Kempic, Jeffrey [Kempic.Jeffrey@epa.gov]; Christ, Lisa [Christ.Lisa@epa.gov]; Donahue, Lisa [Donahue.Lisa@epa.gov]; Lytle, Darren [Lytle.Darren@epa.gov]; Rasso, Mark [Rasso.Mark@epa.gov]; Schutz, Michelle [Schutz.Michelle@epa.gov]; Porter, Andrea [porter.andrea@epa.gov]; Robinson, Matt M. [Robinson.MattM@epa.gov]; Schock, Michael [Schock.Michael@epa.gov]; Shao, Nicole [Shao.Nicole@epa.gov]; Smith, Lameka [Smith.Lameka@epa.gov]; Mehta, Suril [Mehta.Suril@epa.gov]; Marshall, Wendy [marshall.wendy@epa.gov]
CC: Anne Jaffe Murray [anne.jaffemurray@cadmusgroup.com]; Christine Maloni Hoover (choover@paoca.org) [choover@paoca.org]; Darrell Osterhoudt (dosterhoudt@asdwa.org) [dosterhoudt@asdwa.org]; Jim Taft [jtaft@asdwa.org]; Justin Snair (jsnair@naccho.org) [jsnair@naccho.org]; Michael Deane (michael@nawc.com) [michael@nawc.com]; Mike Keegan (keegan@bookcase.com) [keegan@bookcase.com]; Paul Schwartz [paul1959421@yahoo.com]; Petra Smeltzer (petra@nawc.com) [petra@nawc.com]; Scott Biernat (biernat@amwa.net) [biernat@amwa.net]; svia@awwa.org; Susan Satter (ssatter@atg.state.il.us) [ssatter@atg.state.il.us]; Thomas Plant (TPlant@bphc.org) [TPlant@bphc.org]; Gail Bingham [gbingham@resolv.org]
Subject: RE: NDWAC LCRWG: April meeting action items
Attachments: removed.txt; NDWAC LCR Work Group Report DRAFT THREE 5 25 2013 clean.docx; NDWAC LCR Work Group Report DRAFT THREE 5 25 2013 track changes.docx

Greetings – and best wishes for Memorial Day.

Attached is draft three of the LCRWG report, both a track changes version and a clean copy. ***Please send me your comments on the clean version by June 4***. My guess is that using the clean version will be easiest on you as well, since there are so many changes from the April meeting, assignments taken on by members, comments from others on the CCT and monitoring write up, and the results of the two compliance small group calls. The track changes version is meant to be a reference.

The action items from the last meeting provide for this interim review so that the version to work from at the June meeting (which would be draft four) is as far along as possible. I suggest the following approach to comments (which is the approach I took to the edits):

1. Insert text in track changes for editorial comments and for points of agreement by the group that I've missed.
2. Insert comment fields (or put comments in an email with page and line number references) where you disagree or think there's an important issue for the group to discuss.

Finally, I apologize / ask for your understanding that I haven't included the table that captures the implementation schedule and concepts for the LSL replacement program. I am working from Spokane during a family trip and just simply can't find the updated work done by a few of you following the last meeting. Tom, if you have the most recent copy and can send it to everyone, I'd be grateful.

Lots of reasons that it's good this is an interim version! Thank you all, Gail

Gail
Ph: (202) 965-6200 | Cell Ex. 6 Personal Privacy (PP)

From: Gail Bingham
Sent: Tuesday, April 28, 2015 12:42 PM
To: Aaron Bell; Bob Clement; Brian D'Amico (damico.brian@epa.gov); Brian Smith; Cantilli, Robert; Darman.Leslie@epamail.epa.gov; Darryl Adams; DeMarco.Carol@epamail.epa.gov; Dennis Guignet (Guignet.Dennis@epa.gov); Ellie Kwong; Ellis, Jerry; Erickson, Dana; Evangelia Palagian; George Rizzo; Glenn Farber; Helm, Erik; Jason Gambatese; Joyce Donohue; Kempic.Jeffrey@epamail.epa.gov; Lisa Christ; Lisa Donahue; Lytle, Darren; Mark Rasso; Michelle Schutz (Schutz.michelle@Epa.gov); Porter, Andrea; 'Robinson, Matt M.'; Schock.Michael@epamail.epa.gov; Shao.Nicole@epamail.epa.gov; Smith.Lameka@epamail.epa.gov; Suril Mehta; Wendy Marshall (marshall.wendy@epa.gov)
Cc: Anne Jaffe Murray; Christine Maloni Hoover (choover@paoca.org); Darrell Osterhoudt (dosterhoudt@asdwa.org); Gail Bingham; Jim Taft; Justin Snair (jsnair@naccho.org); Michael Deane (michael@nawc.com); Mike Keegan (keegan@bookcase.com); Paul Schwartz; Petra Smeltzer (petra@nawc.com); Scott Biernat (biernat@amwa.net); Steve Via (svia@awwa.org); Susan Satter (ssatter@atg.state.il.us); Thomas Plant (TPlant@bphc.org)
Subject: NDWAC LCRWG: April meeting action items

Thank you all for a very productive meeting last week. I will be sending out a calendar invite for the June 24-25 meeting shortly, along with a doodle request for the webinar with NDWAC, similar scheduling requests for the Copper and Compliance small groups, and a variety of individual reminders.

Major milestones over the next two months are as follows:

- 5/1 – CCT/Monitoring section rewrite (comments by 5/6 would be helpful)
- 5/8 – a rewrite of the draft report to the compliance small group, with as many edits as possible (If you have a drafting assignment, this means getting those back from you this week or early next week)
- 5/25 – draft 3 to the entire LCRWG for comment and to begin drafting the power point for the NDWAC (this is later than discussed last week in order to incorporate the work of the compliance small group)
- 6/4 – LCRWG comments to Gail on draft 3
- 6/12 – draft 4 to the LCRWG for discussion at the meeting (the power point for the NDWAC webinar will be updated as needed so it's consistent)
- TBD – webinar with NDWAC
- 6/24-25 – final LCRWG meeting

Please let me know if you have any questions. Gail

Gail Bingham
Ph: (202) 965-6200 | Cell Ex. 6 Personal Privacy (PP)

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Report of the Lead and Copper Rule Working Group
To the National Drinking Water Advisory Council

THIRD DRAFT

[NOTE: THIS DRAFT WAS PREPARED FOR DISCUSSION BY THE LCRWG AT ITS MEETING ON JUNE 24-25, 2015. THIS DRAFT IS BASED ON THE LCRWG'S APRIL 23-24 MEETING AND INPUT FROM SMALL GROUP CALLS HELD IN MAY. IT DOES NOT REFLECT A CONSENSUS OF THE WORKING GROUP. ADDITIONAL EDITS ARE ANTICIPATED.]

MAY 2015

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Appendices

Appendix A – Lead and Copper Working Group Members

Appendix B – Table 2

Figures

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Abbreviations

AL – Action Level
ALE – Action Level Exceedance
CCR – Consumer Confidence Report
CCT – Corrosion Control Treatment
EPA – Environmental Protection Agency
LAL – Lead Action Level
LCR – Lead and Copper Rule
LCRWG – Lead and Copper Rule Working Group
LSL – Lead Service Line
LSLR – Lead Service Line Replacement
LTR LCR – Long Term Revisions to the Lead and Copper Rule
MCLG – Maximum Contaminant Level Goal
µg/L – Microgram per Liter
µg/dL – Microgram per deciliter
NDWAC – National Drinking Water Advisory Committee
OGWDW – Office of Ground Water and Drinking Water
OCCT – Optimum Corrosion Control Treatment
OWQP – Optimal Water Quality Parameter
PE – Public Education
pH – Negative log of hydrogen ion molar concentration
PLSLR – Partial Lead Service Line Replacement
POTW – Publicly owned treatment works
POU – Point-of-use treatment device
PWS – Public Water System
SAB – Science Advisory Board
SDWA – Safe Drinking Water Act
SRLF – State Revolving Loan Fund
TT – Treatment Technique
WQP – Water Quality Parameter

DRAFT

Report of the Lead and Copper Rule Working Group to the National Drinking Water Advisory Council

1. Executive Summary

The Lead and Copper Rule Working Group (LCRWG) of the National Drinking Water Advisory Council (NDWAC) has completed its deliberations on issues associated with long term revisions to the Lead and Copper Rule (LCR). This report includes the group's findings and recommendations.

This executive summary provides a brief overview of the report. Details of the findings and recommendations are provided in the body of the report. A list of the members of the working group can be found in Appendix A.

1.1. Charge

The charge to the LCRWG was to provide advice to the NDWAC as it develops recommendations for the U.S. Environmental Protection Agency (EPA) on targeted issues related to long term revisions to the Lead and Copper Rule (LCR) under the Safe Drinking Water Act (SDWA).

1.2. Findings and Recommendations

There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for children and other vulnerable populations with both acute and chronic exposures. The lack of resources to reduce the sources of exposure in some communities also raises important questions of disparate impact and environmental justice.

Specific recommendations of the LCRWG include revisions to the LCR to:

- Require proactive LSL replacement programs and improved access to information about LSLS, in place of current requirements in which lead service lines (LSLs) must be replaced only after a lead action level (AL) exceedance and CCT;
- Develop stronger public education requirements for lead and LSLs;
- Strengthen corrosion control treatment (CCT);
- Modify monitoring requirements;
- Establish a health-based, household action level; and
- Separate the requirements for copper from those for lead.

The anticipated Long Term Revisions to the Lead and Copper Rule (LTR LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential. However, although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other agencies. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

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2. Considerations and Background Information

2.1. Considerations in Preparing this Report

The members of the LCRWG brought different perspectives and expertise to the preparation of this report. Although not all members agreed with each and every point below, the LCRWG took one another's perspectives into account and, thus, the following concepts collectively underlie the recommendations in this report. Additional detail is provided in the recommendations section below.

- There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for children and other vulnerable populations with both acute and chronic exposures.
- Lead-bearing plumbing materials pose a risk at all times (not just when there is a lead action level (LAL) exceedance).
- Effective elimination of lead materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility. PWSs, consumers, building owners, public health officials and others each have important roles to play.
- The anticipated Long Term Revisions to the Lead and Copper Rule (LTR LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. However, additional action beyond the scope of the Safe Drinking Water Act is needed. Removing lead from drinking water systems also will require renewed commitment, cooperation and effort by government at all levels and by the general public. (See Section 5: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)
- Proactive action is needed to remove the sources of lead, with appropriate incentives to encourage such action both for (PWSs) and their customers. .
- Successful implementation of the revised LCR can only take place in the context of a more holistic effort on lead in water issues involving stakeholders other than just EPA and water systems, and resources beyond those able to be brought to bear by water systems. Partnerships at all levels are essential. Recognizing that public agency budgets are tighter than ever, greater engagement by local health agencies, those funding housing programs, and those involved in permitting and construction is particularly important.
- Creative financing mechanisms also will be needed to achieve this goal for all individuals potentially exposed to lead, regardless of race, ethnicity or income. Leaving a lead service line in place because a low-income resident does not have the means to pay raises serious questions of disparate impact and environmental justice.
- The public plays a critical role in protecting their families' health by reducing exposure to lead and copper, and informing the public enables them to be effective participants in implementing their share of the responsibility.
- The characteristics of the issues associated with lead and copper are very different.
- The LCR should remain a treatment technique rule, but it can be improved.
- Optimum corrosion control treatment (OCCT) is very complex and dynamic, so providing technical assistance to PWSs is important.
- Attention to unintended consequences is important in complex situations such as the LCR.

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- Attention to what systems can implement and States are able to oversee and enforce also is important.
- Reducing complexity by eliminating or modifying requirements that increase system burden without achieving reasonable reduction in lead and/or copper exposure can allow resources to be focused on actions that better achieve health outcomes.

2.2. Historical Trends

Historically, in addition to modern uses in gasoline, food and paint (now generally prohibited as additives in the United States and many other countries) and consumer products, lead was used for water pipes, in lead alloys (bronze, brass) for plumbing fittings, and in lead solders, in part due to its durability and malleability. In the early twentieth century, lead pipes were replaced by other materials, such as plastics, but existing lead pipes remain in place in many cities and lead alloys continued to be used until very recently.[1]

Progress has been made in reducing the levels of lead in the U.S. population in recent decades, from all sources of exposure. However, at the same time, growing understanding about the public health risks of lead and of what has been learned through implementation of the LCR calls on all involved to rethink efforts to reduce exposure to lead in drinking water.

The U.S. Public Health Service published a non-enforceable standard for lead in 1925, consisting of a tolerance limit (blood lead level or BLL) of 0.1 mg/L.[2] Its successor, the Centers for Disease Control and Prevention, recently redefined the "level of concern" downward to 5 µg/dL (or 0.05 mg/L). The 1986 Safe Drinking Water Act amendments defined "lead-free" plumbing and prohibited the use of plumbing for public water supply that did not meet the new definition. The amendments also required EPA to set standards limiting the concentration of lead in public water systems. EPA first issued the lead and copper rule on June 7, 1991.[3] The latest modification was issued October 10, 2007. Following the adoption of the 1991 rule, public water systems serving more than 50,000 people were required to implement corrosion control, among other requirements. All public water systems had to implement tap sampling, and to take specific actions if samples exceeded an action level. (See Regulatory Background below for additional information on the regulations.)

The Centers for Disease Control and Prevention (CDC) tracks blood lead levels (BLLs) from all sources for the non-institutionalized U.S. population through the National Health and Nutrition Examination Survey (NHANES). The percentage of children ages one through five years with BLLs ≥ 10 µg/dL has decreased over time. (See Table 1.) NHANES data from the 1970s and 1980s also showed disparities by race and income. According to a 2012 assessment published in CDC's *Morbidity and Mortality Weekly Report,* "By the 1999-2004 surveys, the percent differences in BLLs ≥ 10 µg/dL for children aged 1-5

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[1] *Check reference* Safe Drinking Water Act Amendments of 1986. "Prohibition on use of lead pipes, solder, and flux." [HYPERLINK "http://en.wikipedia.org/wiki/Title_42_of_the_United_States_Code" \o "Title 42 of the United States Code"] [HYPERLINK "http://www.law.cornell.edu/uscode/42/300g-6(d).html"]. [HYPERLINK "http://legislink.org/us/pl-99-359"], approved 1986-06-19.

[2] U.S. Public Health Service, Washington, DC (1925). "Report of the Advisory Committee on Official Water Standards." Public Health Rept. 40:693. April 10, 1925.

[3] EPA. "Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Final Rule." *Federal Register,* 56 [HYPERLINK "http://en.wikipedia.org/wiki/Federal_Register" \o "Federal Register"] 26460, 1991-06-07. 40 CFR Part 141, Subpart I.

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years, by race and family income, were no longer statistically significant…"[4] It is beyond the scope of this report to attribute this trend to specific sources of exposure.

TABLE 1. Blood lead levels (BLLs) of children aged 1–5 years — National Health and Nutrition Examination Survey, United States, selected years

Year	% with BLL ≥10 µg/dL	Geometric mean BLL (µg/dL)
1976–1980	88.2	15.0
1991–1994	4.4	2.7
1999–2002	1.6	1.9

"Interpreting and Managing Blood Lead Levels <10 µg/dL in Children and Reducing Childhood Exposures to Lead" Recommendations of CDC's Advisory Committee on Childhood Lead Poisoning Prevention, MMWR, November 2, 2007 / 56(RR08);1-14;16

EPA LCR compliance monitoring data[5] also show a downward trend in the 90th percentile lead concentrations. A comparison of initial compliance monitoring by systems serving more than 50,000 persons conducted from 1992-93 with post-2000 compliance monitoring data found a decrease in lead action level exceedances. After 2000, 17 systems serving more than 50,000 persons had 90th percentile lead concentrations greater than 15 µg/L, compared to 177 systems of that size in 1992-93.[6]

[insert para/graphic about corresponding downward trend in levels of concern]

Commented [GB1]: Nse and Tom

Thus, efforts to reduce lead exposure further, including from drinking water, remain important if society is to achieve a lasting solution to lead exposure from all sources and the resulting protection of public health. For example, recent studies suggest that there can be unanticipated spikes in lead releases in drinking water, often related to particulate releases. Often the tap sampling program missed these spikes because they missed the contribution from the lead service line.[7] Further, LCR compliance data does not show a correlation between lead action level exceedances and water quality parameter violations.[8] Thus, it is reasonable to conclude that corrosion control is an important tool but is not sufficient to prevent high levels of lead from getting into drinking water, particularly from the lead service lines.

Copper is a common material used in household plumbing and drinking water service lines in the United States. Copper is an essential nutrient in small amounts; however, acute ingestion of excess copper in drinking water has been associated with adverse health effects, including acute gastrointestinal symptoms such as abdominal discomfort, nausea, and vomiting.

The SDWA requires EPA to set MCLGs at concentration levels at which no known or anticipated adverse effects would occur, allowing for an adequate margin of safety. EPA proposed an MCLG of 1.3 mg/l for

[4] Brown M and S Margolis, "Lead in Drinking Water and Human Blood Lead Levels in the United States" (2012, MMWR)

[5] U.S. Environmental Protection Agency. 2006. Summary: Lead Action Level Exceedances for Medium (3,300-50,000) and Large (greater than 50,000) Public Water Systems. (updated as of June 1, 2004)

[6] Brown et al "Strategies for assessing optimized corrosion control treatment of lead and copper" Journal AWWA 105:5 May 2013

[7] *Check reference* - Schock M *[insert title and date of webinar presentation]*

[8] *Check reference* - EPA data provided to the LCRWG.

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copper in 1985, and finalized that MCLG in 1991 when the LCR was promulgated. The LCR set the action level (AL) for copper, the level at which treatment technique actions are triggered for the water system, equal to the MCLG. The AL is triggered if 90th percentile level of water samples is exceeded. All community water systems must report the 90th percentile level and the number of samples that exceeded the 90th percentile in their Consumer Confidence Reports.

2.3 Regulatory Background and Formation of the NDWAC Lead and Copper Work Group

Under the Safe Drinking Water Act (SDWA) EPA sets public health goals and enforceable standards for drinking water quality.[9] The Lead and Copper Rule (LCR) is a treatment technique rule. Instead of setting a maximum contaminant level (MCL) for lead or copper, the rule requires (PWSs) to take certain actions to minimize lead and copper in drinking water, to reduce water corrosivity and prevent the leaching of these metals from the premise plumbing and drinking water distribution system components and when that isn't enough, to replace lead service lines under their control. The current rule sets an action level (AL), or concentration, of 0.015 mg/L for lead and 1.3 mg/L for copper. An AL is not the same as an MCL. An MCL is based on health effects and feasibility, whereas an action level is a screening tool for determining when certain treatment technique actions are needed.

The LCR action level is based on the practical feasibility of reducing lead through controlling corrosion. In the LCR, if the AL is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the AL), it is not a violation, but triggers other requirements that include water quality parameter monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education, and lead service line replacement (LSLR). The rule also requires States to report the 90th percentile for lead concentrations to EPA's Safe Drinking Water Information System (SDWIS) database for all water systems serving 3,300 or more persons, and for those systems serving fewer than 3,300 persons only when the lead action level (LAL) is exceeded. States only report the 90th percentile for copper concentrations in SDWIS when the copper action level is exceeded in water systems regardless of the size of the service population. Public education requirements ensure that drinking water consumers receive meaningful, timely, and useful information that is needed to help them limit their exposure to lead in drinking water.

In early 2004, EPA began a wide-ranging review of the implementation of the LCR to determine if there was a national problem related to elevated levels of lead in drinking water. As part of its national review, EPA collected and analyzed lead concentration data and other information, carried out a review of implementation in States, held four expert workshops to discuss elements of the regulations, and worked to understand local and State efforts to monitor for lead in school drinking water, including a national meeting to discuss challenges and needs. EPA released a Drinking Water Lead Reduction Plan (DWLRP) in March 2005. This plan outlined short-term and long-term goals for improving implementation of the LCR. The plan can be found at the following web address: [HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_review.cfm"]

In 2007, EPA promulgated regulations, which addressed the short-term revisions to the LCR that were identified in the 2005 DWLRP. These requirements enhanced the implementation of the LCR in the areas of monitoring, treatment, LSLR, public education, and customer awareness. These revisions better

[9] EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

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ensured drinking water consumers receive meaningful, timely, and useful information needed to help them limit their exposure to lead in drinking water.

A number of Safe Drinking Water Act (SDWA) amendments aim to reduce lead in drinking water by limiting the amount of allowable lead in plumbing materials that come into contact with drinking water. In 1986, the SDWA was amended to prohibit the "use of any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, in the installation or repair of (i) any public water system; or (ii) any plumbing in a residential or non-residential facility providing water for human consumption, that is not lead free". Lead Free was defined as solder and flux with no more than 0.2% lead and pipes with no more than 8% lead.

Congress again amended the SDWA in 1996, to prohibit the introduction into commerce of any pipe, pipe or plumbing fitting or fixture that is not lead free and to also require pipes, pipe or plumbing fittings or fixtures be in compliance with 3rd party lead leaching standards. These provisions ensure that only products meeting the lead free definition are sold in the U.S. and that pipes, pipe or plumbing fittings or fixtures are certified to be lead free.

The Reduction of Lead in Drinking Water Act of 2011 revised the maximum allowable lead content from not more than 8% to not more than a weighted average of 0.25% lead and included a calculation procedure for determining the weighted average; further reducing the amount of lead in contact with drinking water. It also eliminates the federal requirement to comply with the lead leaching standard and included exemptions from the lead free definition for plumbing devices that are used exclusively for non-potable services and also for specific plumbing devices such as toilets, bidets and urinals. The Community Fire Safety Act of 2013 further amended SDWA to add fire hydrants to the list of exempted plumbing devices.

EPA has continued to work on the long-term issues that required additional data collection, research, analysis, and full stakeholder involvement, which were identified in the 2005 DWLRP and the 2007 rule revisions. This action is referred to as the LCR Long-term Revisions (LTR). The LCR LTR would apply to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). In this report, the term public water system (PWSs) is meant to refer to both of these categories but not to transient non-community water systems.

Seeing the need for additional input on potential revisions to the Lead and Copper Rule, EPA requested that the National Drinking Water Advisory Committee (NDWAC) form the Lead and Copper Rule Working Group (LCRWG) to consider several key questions for the LCR LTR, taking into consideration previous input. The LCRWG met seven times in 2014 and 2015 to produce this report, and sought input from the NDWAC in advance of the last meeting to understand and address questions the NDWAC might have about the working group's recommendations.

A list of members of the working group is provided in Appendix A. [*add following approval*...This report was approved by consensus of the LCRWG.]

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3. Recommendations for Revisions to the Lead and Copper Rule

The anticipated long term revisions to the LCR is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential.

The LCRWG offers the following recommendations, based on information provided to the work group and on the work group's own deliberations. The LCRWG considers these recommendations to be an integrated package, not a menu of choices from which some recommendations can be selected and combined with others. This package reflects a concerted attempt to strengthen public health protection, which includes targeting the resources available to PWSs for the greatest public health value. While individual members might differ on specific recommendations, it is the consensus of the work group that this package of recommendations constitutes an improvement over the current LCR.

Commented [GB2]: This question will be asked again at the June meeting.

The diagram on the following page illustrates the conceptual framework of the recommendations that follow.

The LCRWG specifically recommends that EPA revise the LCR to:

- Require proactive LSL replacement programs and improved access to information about LSLS, in place of current requirements in which lead service lines (LSLs) must be replaced only after a lead action level (AL) exceedance and CCT;
- Develop stronger public education requirements for lead and LSLs;
- Strengthen corrosion control treatment (CCT);
- Modify monitoring requirements;
- Establish a health-based, household action level; and
- Separate the requirements for copper from those for lead.

However, although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other agencies. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

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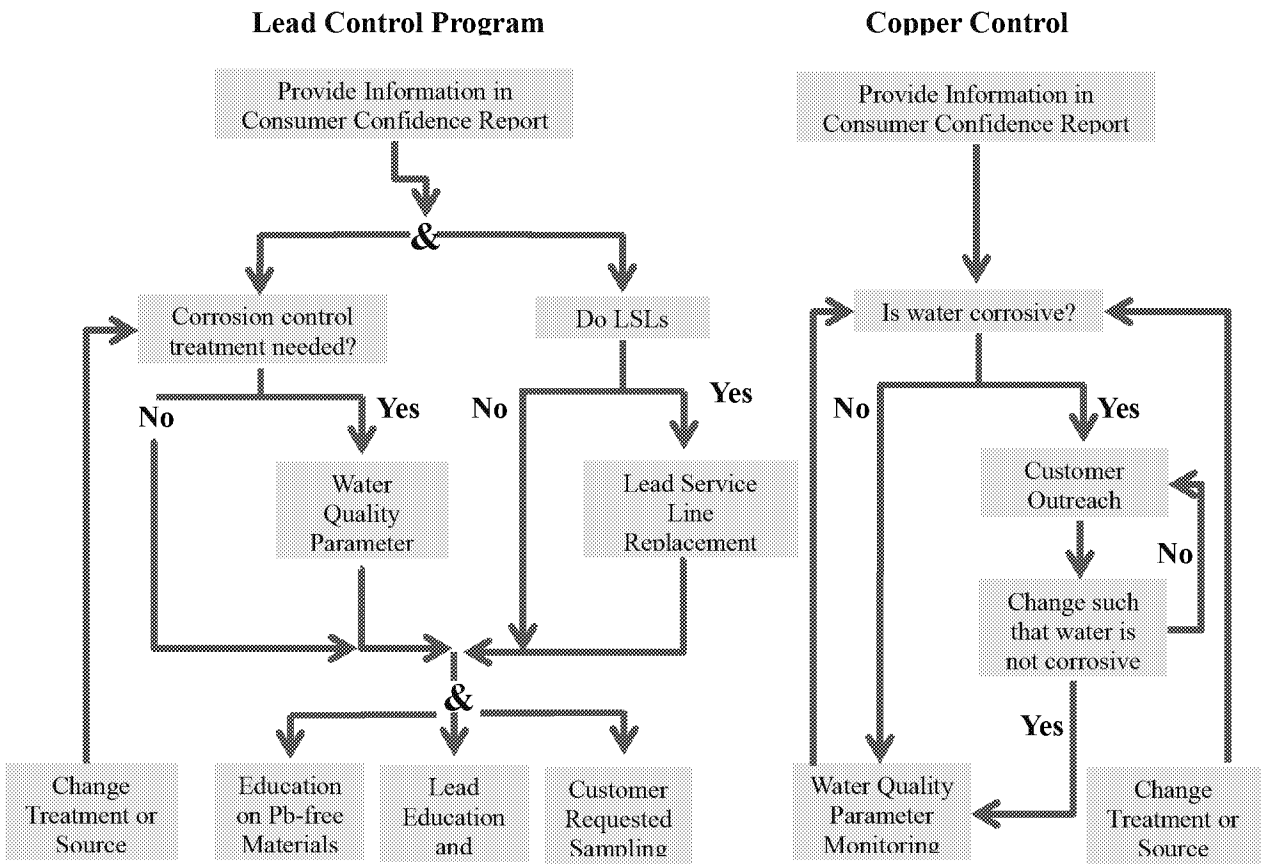
1

2 .

Commented [GB3]: This is a first draft. PE recommendations are missing. Other comments welcome.

Overview of Recommended LT-LCR Framework



3.1. Replace Lead Service Lines

Commented [GB4]: A member asked that there be a definition of a lead service line.

Need also to find a location for clarity that the goal is full LSLR not partial.

Removing the sources of lead in drinking water should be a national goal. More proactive action than has taken place to date is needed to achieve it.

Although success in achieving this goal will require a concerted effort by many and can not be accomplished solely through the authorities provided under the Safe Drinking Water Act, revisions to the Lead and Copper Rule are an important component to achieving this goal and should be structured accordingly. [See Section 4 for recommendations that complement revisions to the LCR.]

The existing LCR has not created sufficient incentives to fully replace LSLs and other sources of lead (such as from premise plumbing), because replacement is only required when the lead AL has been exceeded and optimizing CCT is insufficient to bring a system back under the action level. Systems that do not exceed the lead Al will never have to implement a LSL replacement program. Further, the link to action level exceedance does not allow adequate time for a well-planned LSLR program, and a significant unintended consequence where systems have had to implement a LSL replacement program quickly has been an increase in partial LSL replacement.

EPA asked the Science Advisory Board (SAB) to evaluate the current scientific data regarding the effectiveness of PLSLR and the review centered around five issues: (1) associations between PLSLR and blood lead levels in children; (2) lead tap water sampling data before and after PLSLR; (3) comparisons between partial and full LSLR; (4) PLSLR techniques; and (5) the impact of galvanic corrosion. The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of PLSLR in reducing drinking water lead concentrations. The small number of studies available had major limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating PLSLR efficacy.

While recognizing the limits to current data, the SAB concluded that PLSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months, and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to increase then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR. The SAB also concluded that in studies comparing full LSLR versus PLSLR, the evaluation periods were too short to fully assess differential reductions in drinking water lead levels. However, the SAB explained that full LSLR appears generally effective in reliable achieving long-term reductions in drinking water lead levels, unlike PLSLR. Both full LSLR and PLSLR generally result in elevated lead levels for a variable period of time after replacement. The limited evidence available suggests that the duration and magnitude of the elevations may be greater with PLSLR than full LSLR.

Taking all of these considerations into account, the LCRWG has concluded that an effective framework for replacement of LSLs would include the following and the LCR should be revised accordingly:

- Requiring all PWSs establish a LSL replacement program unless they can demonstrate that LSLs are not present in their system;
- Clear guidance, case studies, and templates for LSL replacement programs, including a toolkit of ideas for creative funding strategies;

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- Targeted outreach to customers with LSLs;
- Dates by which systems should have begun and completed replacement of all LSLs and PSLSs, without penalty to PWSs for those homeowners who refuse to participate in the replacement program as long as the PWS has made a meaningful effort to work with such a homeowner;
- Understanding where LSLs and PLSLs exist, while making action on replacement the priority;
- Programs in place addressing operations that disturb LSLs, educate consumers, and provide voluntary sampling of consumer taps; and
- Avoiding the time and expense of upfront plan approval and using simplified reporting to the states so they would only need to intervene when problems arise.

3.1.1. Update inventories and improve access to information about lead service lines

Updating and improving access to information about the location of both full and partial lead service lines is both essential to ensuring LSLs are replaced and important for successful, proactive outreach to customers who are most likely to have a LSL.

The LCRWG recommends combining:

1) The presumption that a service line put in place prior to the date when lead service lines were prohibited has lead materials unless the PWS has information to show that it not, with

2) Providing credit to a PWS toward its replacement goals for demonstrating that a LSL does not have lead materials.

This approach is intended to create incentives for prompt action to develop an accurate inventory of LSLs and PLSLs, time to organize an effective replacement program, and an opportunity to take action to replace LSLs rather than devoting time and resources on planning documents that must be approved by the primacy agency.

The LCRWG recognizes that PWSs vary in the amount of information they have about the location of full and partial LSLs.

In addition, the LCRWG recommends that all PWSs should establish a clear mechanism for customers to access information on LSL locations (at a minimum). Detailed public education recommendations for both lead and copper follow in separate sections. With respect to information about LSLs, PWSs should:

- Have outreach materials that indicate that property specific information is available.
- Inform customers who may have LSLs about the risks of partial line replacement, who is responsible for replacing the service line, and the legal basis of that determination.
- Provide information it has about LSLs to existing home owners and residents on request.
- Provide information to realtors, home inspectors, and potential home buyers on request
- Communicate that this information is subject to disclaimer for accuracy based on information available to utility.
- Develop a system to track LSL replacement from PWS.

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Where a service line serves multiple dwellings or places such as schools or child care centers that have many children, EPA should establish a formula for giving an extra weight or numerical count to these lines in the initial inventory to recognize the additional children that would be affected.

3.1.2. Establish active LSL replacement programs

Proactive LSL replacement programs are key to moving to a future in which lead is not in contact with drinking water. To accomplish this, the LCRWG recommends replacing the current regulations, in which LSL replacement is required only if a PWS has a lead AL exceedance and after the PWS takes action to optimize CCT, because this has not resulted in the complete replacement of many LSLs across the country.

Commented [GB5]: Question from a member: is there data on how many existed when the LCR was first promulgated and how many exist now?

Instead, a revised LCR should include a direct requirement that all PWSs with lead service lines prepare and implement a LSL replacement program, along with a combination of changes to the regulatory approach described in this report and supportive actions by other public and private agencies, customers and other stakeholders. Taking this approach has the advantages of making replacement of LSLs something all systems do and of establishing programs that are put in place in an organized and measured way.

Supportive actions include increased funding of federal lead risk reduction programs under the Department of Housing and Urban Development (HUD) to help fund customer-owned portions of LSLs and to consider federal tax deductions for this purpose. Additionally, states should pass legislation requiring inspection, disclosure and/or replacement of LSLs on sale of property, and when lines have been disturbed as part of a renovation. Details on these and other ideas are included in Section 4 of this report.

The LCRWG recommends that EPA include the following revisions to the LCR:

1. *Goal:* Require PWSs to work with their customers to replace all lead service lines in their service areas within [20] years of the effective date of the rule. The LCRWG urges PWSs work with their customers to replace LSLs in their service areas more quickly, but recognizes in recommending this timeframe that a mandatory LSLR program adds a new and potentially costly requirement for utilities with LSLs who currently are not and may not ever be triggered into a LSLR program under the current rule.

2. *Interim Milestones:* PWSs that identify LSLs in their inventory should be required to perform targeted outreach aimed at replacement of that inventory of LSLs according to a sequence of three-year milestones,[10] beginning 36 months after the effective date of a revised LCR. Milestones would be set at a faster pace in earlier years and would recognize progress may be more difficult to achieve in later years with those LSLs that remain at that time. Table 2 provides an illustration of this concept. PWSs are encouraged to contact a larger number of homeowners than needed for compliance, since some homeowners may fail to reply or may refuse to participate.

Commented [GB6]: See separate document for Table 2.

3. *Replacement Credit:* The following actions can be counted toward the cumulative replacement requirement:
   - Full LSL removal

[10] Three years is a standard reporting timetable for drinking water regulations.

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- Confirmation that an LSL included in the initial inventory is not lead.

PLSLR will not be counted toward this requirement. Lack of response or refusal to participate by the customer also will not count toward replacement milestones.

4. *Targeted Outreach*: EPA should create a checklist in the rule of approved outreach methods for contacting customers with LSLs and inviting them to participate in the utility's LSLR program. EPA also should provide guidance and/or templates for these methods to encourage best practices in customer communication. For compliance purposes, the revised LCR should require that a PWS individually notify customers with LSLs describing the risks of lead in drinking water, specifically inviting them to participate in the LSLR program, and clearly describing the terms of the program, and how to follow up. If the customer does not respond or chooses not to participate, the PWS must follow up with another invitation at least every three years and always when there is a new customer at that address.

5. *Control and Responsibility:* The revised LCR should require PWSs to clearly state how the PWS defines ownership of LSLs, who has what financial responsibility for the replacement, what the legal basis is for that determination and any financial assistance programs that may be available.

6. *Planning and Funding Options:* EPA should provide a template and guidance for planning LSL replacement programs, including reference to options to assist customers replace their portion of lead service lines. Small systems may wish to refer to a national information source, such as one provided by EPA; large systems may wish to tailor such information to their circumstances. Financial assistance and affordability options EPA may want to describe in guidance and PWSs could consider include but are not limited to:
   a. Rate design considerations:
      i. Low rates for low volumes
      ii. Household size-based rates
   b. Non-rate policies
      i. Budget billing
      ii. Fixture retrofits and plumbing assistance by the PWS
      iii. Service line replacement and insurance programs not provided by PWS
      iv. Direct assistance, emergency bill payment relationships
      v. Fixture retrofits and plumbing assistance by NGO organizations providing affordable housing
      vi. Subsidies including LSL / connection replacement costs associated with street, sidewalk, and other repairs not related to drinking water infrastructure
      vii. On-bill financing provided by the PWS
   c. Funding guidance
      i. EPA's Financing for Environmental Compliance – Water
      ii. Tools for Financing Water Infrastructure
   d. Funding sources beyond rate revenue:
      i. EPA's Drinking Water State Revolving Loan Fund (SLRF)
      ii. USDA's Water and Environmental Programs, U.S. Department of Agriculture, Rural Development
      iii. HUD's Community Development Block Grant Program – U.S. Department of Housing and Urban Development
      iv. EPA Targeted Grants to Reduce Childhood Lead Poisoning
      v. HUD Healthy Homes Technical Studies
      vi. HUD Office Healthy Homes and Lead Hazard Control Lead Hazard Reduction Demontration Program

Commented [GB7]: Draft language provided by Bob Steidel per assignment at April LCRWG meeting

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vii. HUD Health Homes Initiative Lead Elimination Action Program
viii. HUD Office of Healthy Homes and Lead Hazard Control Lead Hazard Control Lead Technical Studies Grant Program

The LCRWG recommends that:

Commented [GB8]: Bob S will have a handout at the meeting to clarify these suggested recommendations

- EPA clearly state the prioritization of LSL replacement within the planning priorities of the drinking water infrastructure needs as a subcategory of transmission and distribution.
- EPA seek an increase of approximately $10 million to the base Drinking Water SRLF appropriation (approximately 0.5% of the current allotment received by the top 15 states) each year of the first three years after adoption of the revised LCR, reserving those funds for PWSs to use for LSL replacement pilot programs to place into operation the funding alternative methods also being recommended to EPA. Those pilot programs would further refine current recommendations and develop new methods of service delivery for LSL / connection replacement.
- Regardless of the programs the PWS is required to create to work with customers to replace LSL / connections, a recommendation to EPA is prior to implementation of a new mandate from a changed LCR to replace LSL / connections, the PWS determine the affordability for the customers within their service area. PWSs may use methodology from Manual M1 (Principles of Water Rates, Fees, and Charges Rate Manual) or Raftelis (Water and Wastewater Finance and Pricing, 4th Edition 2015) or a combination of both, and that the method used determines household relative affordability (EPA (National Drinking Water Advisory Council 2003). The governing board of the PWS will adopt household relative affordability as policy and if the PWS rates applied to the customers exceed that adopted policy, the prioritization of needs and expense will be funded as determined by that governing board.

7. *Operations and Customer Engagement:* EPA also should provide guidance on PWS policies and procedures for how to engage customers in full lead service line replacement and to inform them on appropriate risk reduction measures. PWSs should adopt templates provided in guidance by EPA or, for larger systems, their own standard operating procedures (SOPs) and make them available to their customers and the primacy agency for:

a) planned capital projects that would require:
   - Prior notification (e.g., 45 days prior to planned main replacement or repair) - Contact letter to affected households likely to have lead service lines, providing information about lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
   - Reminder of flushing post LSLR (e.g., 48 hours prior to actual field work affecting structure) -- Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

b) emergency main and service line repairs that would define how to manage potential disturbance to LSLs safely:
   - Direction to information on lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
   - Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

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c) flushing of service lines after lead service line replacement:
   - flush outside hose bib
   - Initial flush followed by house flush by homeowner or plumber using multiple taps to maximize water velocity
   - Proper use of filters when lead levels might be high

d) Activities of other utilities (e.g. power, cable) when those latter utilities are engaged in construction that affects water service lines or water mains to:
   - Provide information to the other utility about how to manage potential disturbances safely
   - Alert affected residents to information on flushing and the proper use of filters when lead levels might be high

Commented [GB9]: Needs further discussion about what a PWS can be expected to know. Also, a member asked, What should be required and what should be in guidance?

8. A revised LCR also should include the following requirements for individual structures or campuses of buildings that are "public water systems" and own their own pipes.

   - Non-community water systems with lead service lines should replace lead piping within xx years of the effective date of the revised LCR.

   - Individual businesses, nonprofit organizations, and governmental buildings or campuses that are operated as "public water systems" (e.g., hospitals, churches, schools, jails, etc.) should replace LSLs within xx years of the effective date of the revised LCR.

Commented [GB10]: Clarify how these bullets differ

Commented [GB11]: Timing?

The LCRWG discussed and agreed that EPA guidance should encourage PWSs to make every effort to ensure that LSL replacement provides equal protection to low income customers (or rental units with low income residents), people of color and others protected by civil rights law and policy. Environmental justice and civil rights considerations are particularly important in those jurisdictions where the PWS requires the property owner to pay a share of the costs of removing the LSL. Making environmental justice a priority can be achieved through creative funding programs for low-income customers and setting priorities for which neighborhoods are targeting first for LSLR to ensure equal treatment of low income neighborhoods.

The LCRWG also discussed but did not agree that the definition of control as ownership should be changed in the revised LCR. In the current lead and copper rule, when a system exceeds the LAL, EPA requires water systems to replace only that portion of the LSL that it owns. This is based on EPA's current interpretation of the term "control" in the definition of public water system as limited to ownership. Some members of the LCRWG urged that the current definition of control as "ownership" should be replaced with a requirement that PWSs must replace the entire LSL, where they have the authority to "replace, repair, or maintain" the line or where they have other forms of authority over the LSL. However, the LCRWG also recognized that some utilities are prevented by law from spending public funds on private property and that gaining physical access to private property poses significant legal issues when a property owner objects.

The LCRWG does agree that the revised LCR should require PWSs to inform customers about the scope of their responsibility and the legal basis for that decision.

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3.1.3 LSL Compliance

Commented [GB12]: How complete do the compliance sections need to be? Would the LCRWG want (or not) to characterize them as a starting point, with the suggestion that EPA review the recommendations above to check if anything is missing?

3.1.3.a LSL Replacement Compliance

Recordkeeping:

- Inventory of LSLs

Reporting: At the end of each three year period, each PWS must provide to the state primacy agency:

- Certification of the outreach conducted (see above for outreach requirements);
- Report on the change in the number of LSL removed from the inventory with better information;
- Report on the number of full LSL removed; and
- Report on locations where the utility side LSL was removed, but the homeowner refused to replace private portion

Commented [GB13]: Check for what the recommendations say about requirements to notify the homeowner before a partial LSLR is performed.

Violations:

- Failure to conduct required outreach;
- Failure to step up intensity of outreach if 3-year LSL target has not been met;
- Failure to provide on-going outreach (at least every 3 years) to locations with partial LSL
- Outreach materials do not meet the content requirements of the rule

3.1.3.b Operations and Customer Engagement Compliance

CWS must maintain records of who was notified, when notice was given, and content of notice for each capital project. (for 7a and 7b)

Violations:

- Lack of timely notice to customer that LSL removal is scheduled
- Notice materials do not meet rule content requirements

CWS also must develop SOP, and maintain records that it was provided to all utilities conducting activities which may impact LSL (for 7d)

Violation:

- CWS has not developed an SOP (or adopted an SOP template available on the National Clearinghouse) or not provided it to other utilities

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3.2 Develop Stronger Public Education Requirements and Programs for Lead and LSLs

Given the public's role in the shared responsibility nature of the LCR, notifying and educating the public about lead in drinking water is very important for real risk reduction. Public education about the risks of lead in drinking water also is important regardless of whether LSLs are present, since lead can be present in other premise plumbing materials. Moreover, targeted outreach is a key to the success of LSL removal programs. The current LCR does not adequately focus on creating on-going opportunities to educate customers on the risks of LSLs or on opportunities to replace them, especially when action is most likely, e.g. at the sale of a home.

The objectives of public education programs should include consumer understanding of: 1) the risks of lead in drinking water; 2) the likelihood that the water in one's home may contain lead; 3) the LCR as a "shared responsibility" rule; and 4) the availability of additional resources that consumers can use to better minimize their exposure to lead.

Although the LCRWG was briefed on and has experience with public education requirements and practices, it does not include members whose specific area of expertise is consumer-centered risk communication. Thus, the LCRWG generally recommends that public education programs for lead should move away from past practices of one-way communication from "experts" to the "public" toward newer concepts of risk communication that involve sustained, multiple, two-way channels of ongoing communication and partnership with the public.[11] EPA should consult with those with such expertise and encourage and apply best practices in effective ways to communicate with the public.

Communication in languages appropriate to the demographics of the community, in clear terms understandable by the public, and with engaging, reader-friendly graphics, photos, and video all help achieve greater understanding. Outreach programs and materials can be improved by involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies. This information can and should be conveyed in different ways and through different communication channels, tailored to the specific circumstances.

Thus, with these and other considerations in mind, the LCRWG recommends that EPA, in consultation with the aforementioned stakeholders and drawing on principles of consumer-centered risk communication:

- Establish an easily accessible, national clearinghouse of information about lead in drinking water to serve the needs of the public and of public water systems (section 3.2.1).

[11] Resources include: 1) EPA's "Risk Communication in Action" ([HYPERLINK "http://nepis.epa.gov/Adobe/PDF/60000I2U.pdf" \t "_blank"]) ; 2) EPA's "7 Cardinal Rules of Risk Communication" ([HYPERLINK "http://www.wvdhhr.org/bphtraining/courses/cdcynergy/content/activeinformation/resources/epa_seven_cardinal_rules.pdf"]); and 3) Education & Communication WG Report 2010; National Conversation on Public Health and Chemical Exposures ([HYPERLINK "http://www.resolv.org/site-nationalconversation/files/2011/02/Education_and_Communication_Final_Report.pdf"])

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- Revise the current CCR language to address lead service lines and update the health statements (section 3.2.2).
- Add requirements for targeted outreach to customers with lead service lines (section 3.1.1 and 3.2.3).
- Strengthen requirements for public access to information about lead service lines, tap monitoring results, and other relevant information (section 3.2.3).

In addition, the LCRWG recommends that EPA consult with the aforementioned experts and stakeholders about methods that would increase public awareness of and motivation to learn about the effects of lead in drinking water and the benefits of removing these materials and/or taking regular precautions when cooking or drinking, regardless of whether LSLs are present or there has been a lead AL exceedance. Based on this advice, EPA should take small systems into account and also consider whether such methods should be included in guidance or in revisions to the LCR.

3.2.1 National Clearinghouse About Lead in Drinking Water

The LCRWG recommends that EPA take the lead, working with other partners to establish a national, accessible information clearinghouse. The LCRWG suggests that this information clearinghouse include a website, that the materials on the web site be accessible for distribution through the Safe Drinking Water Hotline for those who may not have internet access, and that EPA investigate and apply newer communication technologies and ideas for interactive or other innovative means of communication with the public about lead in drinking water (e.g. social media methods and outreach programs). The clearinghouse should include information in multiple languages, in clear terms understandable by the public, and should include engaging, reader-friendly graphics, photos, and video. In developing this clearinghouse, EPA is encouraged to consult people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies.

Such a clearinghouse would be intended for use by the general public, PWS's, public health agencies, and health professionals.

- It should include information and educational materials for the public that the public could access directly and that PWSs could use to meet many of the public education requirements of the LCR.
- It also would include guidance and templates, particularly for small systems, on SOPs for compliance with the LCR (e.g. templates for communicating lead monitoring results to individual customers, template for explaining to customers how to obtain information on whether their service line could be lead, etc).
- Principles and guidelines for best practices in public education would be important for developing the content of the materials.
- Case examples of how communities have been successful in lead inventory updates and removal programs, information about funding sources, and contacts to other relevant agencies also should be included.
- Further, EPA should consider best practices in methods for achieving greater public awareness of the clearinghouse so that it reaches as many people as possible.

The web site should include the following information:

Health risks

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- Clear and prominent statement that no level of lead in drinking water is safe for human consumption and that a short-term exposure to a young child can result in permanent harm to the brain if the levels are high enough.
- Clear and distinct language on the health risks of consuming lead in drinking water
- Identification of the most vulnerable populations
- Importance of drinking water plumbing as a lead source
- How to have BLLs checked and limitations of testing
- How to have water tested and limitations of testing
- List of labs for testing water other than the utility and what to ask for in terms of number and size of bottles, diameter of mouth of bottles, analysis that measures lead particles, etc.

Commented [GB14]: A member asked whether this could this be elaborated to convey that lead particles can have high potency (e.g. exceeding the CPSC standard used to recall toys) and that the risk of exposure should be taken seriously.

Forms of lead in water and health risk implications

- Soluble
- Particulate
- Unpredictability of lead release

Sources of lead in drinking water

- LSLs
- Other lead-bearing plumbing
- Scale on internal plumbing that can be a source of lead from present or past LSLs

Identification of service line material

- How to recognize a pipe that is made of lead (and when not to check due to age of home)
- What to do about galvanized pipe and why it is a potential source of lead

For homes with LSL

- LSL ownership
- Difference between full and partial lead service line replacement (physically and in terms of health risks)
- Benefits to full LSL replacement
- Actions to take if you have a partially replaced LSL
- Available methods for LSL removal
- Opportunities for removal, approximate cost, and financing options
- Overall benefits to the community of removing LSLs fully (lower treatment costs, better community health, environmental, etc.)
- Where applicable, requirements for notification during real estate transfer or new rental

Health-protective actions

- Precautionary water-use practices
- Role of filters and proper maintenance of them if they are used
- Replacement of leaded plumbing with lead-free plumbing

Additional information

- How to contact your utility and request a LSL inspection and/or water test
- Where applicable, reference to utility-specific website with local lead-related documents and data (e.g. Consumer Confidence Reports (CCRs), sampling protocol used for LCR compliance, lead-in-water test results, etc.)
- What you need to know about lead in water in schools and day care centers (it is not regulated, and link to national website that provides more information)

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- Reference to a national website that provides a video version of basic educational information, including information on how the LCR works (with minority language versions)
- Where to get more information on drinking water, on lead in water, and on lead in general

3.2.2 Revise the current CCR language

The CCR is a necessary but not sufficient source of information for the public. It can provide general information, but is not designed to be frequent or detailed enough for all public education purposes.

All community water systems (CWSs) should continue to include a statement about lead in their CCR. There may be circumstances (e.g. a subdivision built entirely after January 2014 when "lead-free" requirements came into effect), where a CWS can demonstrate that there are no lead-bearing materials in contact with drinking water. EPA may want to consider allowing the primacy agency to waive this CCR language requirement if an entire CWS can meet this this criterion.

The LCRWG recommends that the CCR language should be strengthened to include:

- Public health statements updated to reflect current understandings that there is no safe level of lead and a summary of the health effects, that this risk pertains to everyone, and that some individuals are particularly vulnerable;
- A link to the national clearinghouse should be added to the CCR for all CWSs;
- Recognition that a CWS's compliance with federal regulations does not guarantee what level of lead (lower or higher) might be found at the tap in a particular home; and
- The message that customers play an important role in protecting themselves from exposure to lead.

In addition, the work group recommends that PWSs where full or partial lead service lines exist (or are presumed to exist until an inventory demonstrates otherwise) also add information about what a lead service line is and how to contact the utility for information about how to find out if you have one and why you should replace it.

Further, the LCRWG recommends that the following redraft of the CCR be considered as a starting point for incorporating the elements listed above, to be reviewed by a diverse group of experts involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies.

> ***Important Information from EPA about Lead*** *If lead is present in your drinking water, it ~~elevated levels of~~ can cause serious health problems, especially for pregnant women and young children. Lead can affect children's brains and developing nervous systems, causing reduced IQ, learning disabilities and behavioral problems. Lead is also harmful to adults. Lead in drinking water is primarily from materials and components associated with ~~service lines and~~ home plumbing and service lines (the pipe connecting your home to the water main). ~~(System name) is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components.~~ Contact us for information about lead service lines, how to find out if you have one and why you should replace it. [Last sentence for systems with LSLs.]*

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~~When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.~~ Protecting you against exposure to lead is a shared responsibility. Your water utility is required to minimize the corrosivity of the water. However, because every home is different, the amount of lead in your tap water may be lower or higher than the monitoring results for your public water system as a whole. You can take responsibility for identifying and removing lead materials within your home plumbing and taking steps to reduce your family's risk. If you have lead service lines or lead-bearing materials in your home, ~~are concerned about lead in your water,~~ you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at 1-800-426-4791 or [HYPERLINK "http://www.epa.gov/safewater/lead"]. *[Insert new national web site link]*

3.2.3 Strengthen requirements for public access to information

Commented [GB15]: Yanna and Steve are working on a recommendation regarding outreach to vulnerable populations. (make compliance section consistent with what the WG decides)

The LCWWG supports the public's right to know about the quality of their water and considered various options to increase the public's access to data related to lead and copper.

Under the current rule, the PWS is only required to make publicly available through the Consumer Confidence Reports (CCR) that "90th percentile value of the most recent round of sampling and the number of sampling site exceeding the action level." 40 CFR 141.153. In many jurisdictions, a concerned citizen may be able to obtain or view a redacted version of the complete sampling data set but this approach is time-consuming and burdensome on the PWS (or the state) and the community. EPA receives only a summary of the sampling results.

As the LCRWG evaluated different approaches, we kept in mind EPA's Office of Enforcement and Compliance Assurance (OECA) five principles for highly effective regulations and that OECA is working with regulatory programs to evaluate new and revised rules against these principles. Principle 4 calls for rules to "leverage accountability and transparency by providing the government and the public with real-time access to quality information on regulated entities" emissions, discharges and key compliance activities and outcomes." OECA identified two tools to accomplish this:

- Electronic reporting to the government.
- Public accountability via websites, paper/electronic mailings, and other ways to provide the public and stakeholders (e.g., customers, ratepayers) with compliance information.

The LCRWG encourages EPA to use the SDWIS-Prime data system that is under development to meet the first provision of the above goal. Electronic reporting from utilities to a centralized data system would allow the public to access data from the State or EPA in a coordinated manner and allow for consistent access to all water quality data, not just data for lead and copper.

Commented [GB16]: Define in a footnote?

Until such time as the new data system is in place, though, the LCRWG believes that water systems should increase the availability of data to the public. This would include:

- The number of samples over the Household Action Level in the last monitoring period, the highest level found during the last monitoring period, and the median levels as well as the current "system action level" (renamed from the current action level).
- Requiring water systems to include WQP-related information on their webpage, or in the CCR or some equally accessible manner (e.g., CCT treatment, approved WQP ranges, WQP results from the last monitoring period)
- Encouraging water systems to post additional information on their webpages such as:

Commented [GB17]: Review based on final monitoring recommendations (whether there will be a recommended system action level requirement and, if so, what?)

Commented [GB18]: Review based on final monitoring recommendations

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- Public education materials (and link to National Clearinghouse)
- Sampling protocol the water system provides to customers to use when collecting lead sample and any variations from EPA recommendations.
- Individual sampling results (with appropriate privacy provisions such as address redaction)
- Inventory (such as a map) of confirmed and presumed lead service lines

Where a community has lead service lines, EPA should require PWSs provide a public statement of lead service line ownership and the legal basis of said determination. (See section 3.1.2, point 5 *"Control and Responsibility."*)

Commented [GB19]: NOTE: These ideas have been included in a new paragraph just before 3.2.1, asking EPA to look into methods for communicating this information as well as to draw attention to the information in the clearinghouse generally.

3.2.4 Public Education Compliance

3.2.4.a PE Compliance for CCR

Recordkeeping, reporting and violations: Same as in the current CCR rule, with updated content.

3.2.4.b PE Compliance for Public Access to Information

Commented [GB20]: Is this worded correctly?

PWS must provide the public access to information about:

- Number of samples over the Household Action Level, median and highest level found in the last monitoring period
- CCT treatment, approved WQP ranges and WQP results from the last monitoring period

Violations:

- Failure to make this information available to the public

3.3 Improve Corrosion Control

Corrosion Control Treatment (CCT) involves the addition of chemicals (e.g. orthophosphates or silicate) to create a barrier between the pipes and the drinking water, or to modify drinking water chemistry (such as pH and hardness) to inhibit the potential for corrosion. The concept is to manage the treatment system to reduce corrosion (and, thus, the release of metals such as lead and copper) from the distribution system and premise plumbing.

Under the current LCR, PWSs serving more than 50,000 people were required to work with their primacy agency (typically the state) from 1994 to 1997 to designate and install optimal corrosion control treatment. Systems serving 50,000 people or less must optimize corrosion control treatment only if the results of lead and copper tap sample exceed the action levels. A PWS exceeds the action level if ten percent or more of the tap samples collected are greater than the 15 ppb action level.

Based on the experience with current LCR requirements provided to this work group and shared by work group members, the LCRWG has concluded the following:

- CCT remains an important component of the LCR, in that it is intended to achieve a water quality that minimizes dissolution of lead in water. However, advances in knowledge about CCT, greater awareness of what is not sufficiently well understood, and the implementation of LSL replacement programs by all systems regardless of tap monitoring results and adjustments to

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CCT if the recommendations in this report are implemented all need to be considered going forward.

- Effective CCT is complicated. A variety of factors affect the dissolution of lead in water, including but not limited to pH and alkalinity. Factors other than the stability of designated WQPs can include, among others, the formation/dissolution of protective scales; the presence of manganese, iron, chlorides, sulfates, aluminum and other materials; and temperature. Variations in water quality also can occur within the distribution system. These water quality conditions vary among PWSs, which in turn affect the CCT choices a PWS must make in in the context of other regulatory requirements. Thus, the discussions between the PWS and the primacy agency about the treatment plan and its associated water quality parameters should apply the most current science, tailored to the unique circumstances of each system. Experience with the LCR also suggests that it may be possible to improve CCT by setting tighter ranges to WQPs in some circumstances and by paying more attention to process controls with more frequent monitoring of WQPs. Lead occurs in different forms in plumbing systems, from soluble to insoluble and particulate in nature. PWSs vary in their sources of lead from the very common leaded solder and brass fixtures/valves, to LSLs, and to less common lead-lined iron pipe. CCT is more effective in reducing exposure to soluble lead than it is for particulate lead, which is one of the reasons the LCRWG has recommended that all systems with LSLs be required to replace them rather linking replacement programs to a lead AL exceedance and implementation of CCT.

Commented [GB21]: Is this last statement true?

- In sum, CCT is not the only lead control mechanism that a PWS must have in place. In other words, CCT should not be relied upon by itself to control lead in water. Rather, it should be one of a tool box of other required mechanisms depending on a PWS's particular conditions and lead sources (e.g. LSLs, lead solder, leaded brass, etc.). These tools are described in other sections of this report and include: LSL replacement (as well as the replacement of other less common sources of lead such as lead-lined iron pipe), current and future use of lead-free materials, stronger public education including targeted public education to vulnerable populations, availability of certified POU filters, instructions on how to flush plumbing systems when lead could be disturbed, etc.

Commented [GB22]: A member suggested defining vulnerable populations

3.3.1 Corrosion Control Recommendations

Thus, the LCRWG recommends that:

Commented [GB23]: NOTE: This is based on the proposal discussed at the April meeting. Yanna L discussed another proposal with the compliance small group, which will be put on the June agenda. The comment field below was added to prompt discussion of her proposal.

- EPA release a revised CCT guidance manual as soon as possible and update this manual every six, so that PWSs and primacy agencies can take advantage of improvements in the science;
- EPA provide increased expert assistance on CCT to PWSs and primacy agencies;

Commented [GB24]:

- The LCR continue to require re-evaluation of CCT when a PWS makes a change in treatment or source water;

Commented [GB25]: Should the revised LCR also require re-evaluation of CCT based on monitoring data?

- The LCR continue to require WQP monitoring to ensure that the CCT is achieving the treatment objectives and that EPA consider requiring such monitoring on a more frequent basis with additional guidance on process control methods; and
- The LCRWG recommends that the LCR be revised to require that large systems review their existing CCT plan in light of current science in a newly revised guidance manual with their primacy agency to determine whether the WQPs reflect the best available current science. The LCRWG suggests that this review be done every six years following EPA's six year rule review cycle, and subject to there being sufficient science change that EPA updated the guidance manual. EPA should plan to review and refresh Agency guidance every 6 years, subject to

Commented [GB26]: Is there a way to tier this for medium and small systems, either linked to spikes in tap sampling results, different time tables, other? Could the concept be similar to what small and medium systems already do for wastewater discharge monitoring reports?

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significant improvement in the state of knowledge, to allow research to inform rule implementation. In addition, regularly revised guidance would help states and systems stay current with corrosion control science as they respond to problem situations, but more importantly help them anticipate challenges as new water sources and treatments are brought on line, or they contemplate further refinement to corrosion control.

3.3.2 Corrosion Control Compliance

Commented [GB27]: This reflects the recommendations discussed at the April meeting. Update based on modified or additional recommendations

PWS must maintain records that it reviewed new EPA guidance manuals and assessed the need to make changes to CCT.

Violations:

- Failure to notify and consult with primacy agency on re-evaluating CCT if the PWS makes a change in treatment or source water
- Failure to review CCT when EPA updates the guidance manual (for large systems)
- Failure to act if state notifies them that they should assess CCT or make adjustments, based on state review of guidance manual (for medium and small systems)
-

3.4 Modify Monitoring Requirements

Commented [GB28]: See comments above about alternate proposal.

Under the current LCR, a PWS is required to conduct monitoring to assess the effectiveness of its corrosion control treatment (CCT) 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. In the Lead and Copper Rule (LCR), water systems must prioritize sample site locations (often residences) within the distribution system which are at a high-risk of elevated lead and/or copper in the water. Selection and use of these elevated lead and copper sites enables a smaller number of sample sites than random or geographic site selection procedures.

Implementation of this approach over time has revealed numerous challenges. Recruitment of customers to take in-home samples is difficult. Customers are not professional samplers and, thus, may implement the sampling protocols inconsistently. Research on sampling protocols has shown that sampling results may vary, and not necessarily consistently, based on the configuration and length of lines from the water main to the sampling tap and whether the sample is a first draw or a subsequent sample intended to reflect water that had been in a LSL for some time.

In addition, while such sampling is intended to assess the effectiveness of CCT to achieve public health protection rather than as a direct measure of public health protection itself, concerns about residents of individual households still being exposed to high levels of lead are understandable, whether or not the system as a whole exceeds the AL. Concerns that adjustments to CCT can't reduce public health risk when high lead levels in individual samples may come from particulate lead also must be taken seriously, particularly given the risk of changes to CCT causing unintended consequences to other aspects of drinking water treatment.

The LCRWG recommends two types of on-going monitoring: 1) a more robust water quality parameter monitoring program, and 2) voluntary customer initiated tap water sampling coupled with a more robust and targeted public education program to encourage sampling.

3.4.1 Water Quality Parameter Monitoring

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In this section, WQP monitoring is distinguished from the more extensive list of parameters that a water system would consider as it evaluates corrosion control technology choices. WQPs for the purpose of this section involve the on-going process control monitoring that demonstrates that the selected treatment is being properly operated over time.

Commented [GB29]: Does the LCRWG wish to recommend a broader range of WQPs for process control purposes?

The WQP program recommended below builds on what is in the current rule by recommending (as referenced in Section 4.3 above):

1) more frequent monitoring than present and monitoring that is better distributed through out the distribution system (e.g. at points currently used for TCR monitoring) to capture currently undetected variability;
2) that it be periodically revisited based on the advancing science as documented in research reports and disseminated through periodically revised EPA guidance manuals; and
3) that a more rigorous data review process such as control charting and similar process control techniques be used to take advantage of the collected data to improve the consistency of operation, encourage fine-tuning of processes, reduce variability of water quality within the distribution system and detect and manage excursions.

In addition, this data should be reviewed whenever there is a change in source or treatment (see 4.3 above); and, when a system or state primacy agency sees significant changes in WQP data, it should initiate a "find and fix" process, looking for what changed and why, and requiring the PWS make any needed adjustments or corrections. This provides one type of reality check and correction not explicitly in the current LCR.

In addition, the LCRWG recommends that systems which are not currently practicing CCT under the LCR but have been under the lead action level by virtue of either naturally non-aggressive source water or by virtue of other aspects of treatment in use, be required to conduct a WQP monitoring program to continue to demonstrate that the characteristics which caused them to be non-corrosive are continuing to be in place.

3.4.2 Customer Sampling

The LCRWG also recommends that a voluntary customer-initiated sampling program based on the more robust and targeted public education efforts being recommended elsewhere in this report be substituted for the current LCR tap sampling requirements. Revisions to the LCR should require that outreach to the general public, households with lead services, and vulnerable populations such as pregnant women and households with young children offer free lead sampling.

The results of the voluntary tap sampling program will be used for three separate purposes:

- informing and empowering individual households to take action to reduce risk,
- reporting to health officials when monitoring results exceed a "household action level" (see section ….) and
- ongoing information to the utility to assess effectiveness of CCT.

Information for Households

Data from customer-initiated sampling will be valuable in informing and empowering individual households and thus provide greater customer service. All data provided to customers would need to include appropriate information about the variability of lead levels, that a single sample does not represent all water quality, and that levels at a particular tap at a particular time might be higher or lower. The

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transmittal should also provide appropriate information about the risks of lead exposure, sensitive populations, and actions the consumer can take to minimize risk.

This type of sampling is currently discouraged by the current rule because water systems are often concerned that "complaint" or "customer " samples would be included into the required 90th percentile calculation with potential mandatory response actions if it exceeded the action level. This resulted in system not offering sampling or having the samples be analyzed through a private lab (and therefore the data would not be available for any utility management or regulatory purpose). Currently, PWSs are mandated to return to the same locations which, while it may have value for other reasons, means that many other households do not get the opportunity to understand their lead exposure. Voluntary customer-initiated sampling can also capture data from multi-family residences, which is not included in the mandatory LCR sampling in most cases. A new approach could achieve greater customer service and more data to understand and manage lead corrosion.

Information for Public Health Officials

Data from customer samples which exceeded the "household action level" recommended in section X.x, would be required to be forwarded to health officials. While LCR tap water results are currently provided to the collecting household, the LCR does not require any action for individual high samples, and there is no mandate to refer to health authorities. This recommendation provides direct health intervention in those cases where sampling indicates high lead levels.

Information for Assessing the Effectiveness of CCT

The third use of the customer tap sampling data is to provide on-going information to the utility of potential changes in the effectiveness of CCT. Under the current rule, most systems are sampling for one four-month period every three years. Any changes or variability in lead levels at the tap during the other 32 months of that period are missed. Under this proposal, it is anticipated that there would be a more regular stream of data from more locations, providing information which can be used to understand system performance. The data would be provided to the state primacy agency and presented as time series data to facilitate identifying any changes in the data over time. Small systems might report the data on something as simple as a spreadsheet chart, while larger systems might use more sophisticated analytical methods to understand and use the data.

Unexpected or unexplained changes in the tap sampling data can be used in a "find and fix" approach to identify and respond to potential problems. This could be system initiated or in response to periodic review of the system data by the primacy agency, such as during a sanitary survey. This provides a reality check on whether something unexpected is happening within the distribution system, even though consistent treatment was maintained. The more robust (in both temporal and geographic distribution) of the customer sample data set provides a more powerful check on treatment than the current episodic sampling does.

It seems appropriate to include some sort of floor to the number of customer samples. Some members of the group suggested that systems should be required to collect no fewer samples in a three year period than they would under the current three-year reduced monitoring requirement.

Commented [GB30]: Should there be language describing the types of locations for samples that would be counted as part of the "floor?"

When a system changes its source or treatment, and is required to consult with the state, the state primacy agency also may choose to require additional one-time monitoring to evaluate those changes if the degree of the change warrants.

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Some members suggested that some small systems might want the opportunity to maintain the current home tap water monitoring program. The revised LCR should allow this, while not discouraging customer sampling.

[NOTE: Remaining monitoring text from previous draft was deleted (very long and outdated).]

3.4.3 Sample Invalidation Criteria

Under the existing regulation (141.86 (f)(1)), "The State may invalidate a lead or copper tap water sample if at least one of the following conditions is met.

(i) The laboratory establishes that improper sample analysis caused erroneous results.
(ii) The State determines that the sample was taken from a site that did not meet the site selection criteria of this section.
(iii) The sample container was damaged in transit.
(iv) There is substantial reason to believe that the sample was subject to tampering."

These are all good and necessary reasons for invalidating a sample and should be retained, but because this list is limited, samples must be accepted that are obvious "outliers" and don't represent the water that is normally consumed and should not be used as a basis for treatment changes or public education. This is especially true for small systems where the limited number of samples required means that a single, unusually high, value can cause the Action Level to be exceeded. This could lead to installation of expensive treatment when treatment is not needed or adequate corrosion control is already being provided. While probably not as frequent, non-representative samples could also cause water systems to be below the action level when treatment changes really are needed. Good invalidation criteria can help states address both problems.

The purpose of the invalidation is to make sure that decisions are based on the most representative set of samples possible and to do so through a process that provides adequate information to make good invalidation decisions and assures documentation of the reasoning behind the invalidation.

The following is a proposal from states that will serve those two functions.

States believe that the essential criteria for invalidation are already well stated in the [HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/upload/Revised-Lead-and-Copper-Rule-Monitoring-and-Reporting-Guidance-for-Public-Water-Systems.pdf"] or the October 2006 memorandum on [HYPERLINK "http://water.epa.gov/lawsregs/guidance/sdwa/upload/wsg_178.pdf"]. The language in these documents is consistent with the sampling requirements in 141.86 (b).

- "Always collect a first-draw sample from a tap where the water has stood in the pipes for at least six hours (e.g., no flushing, showering, etc.). However, make sure it is a tap that is used regularly, and not an abandoned or infrequently used tap."
- "First-draw samples collected at single-family residences must always be drawn from the cold-water kitchen tap or bathroom tap."
- "First-draw samples collected from buildings other than single-family homes must always be drawn from an interior tap from which water is typically taken for consumption."
- "Therefore, public water systems should not recommend that customers remove or clean aerators prior to or during the collection of tap samples for lead."

Commented [GB31]: A member commented that this may need to be revisited based on the purpose and role of lead/copper sampling.

3.4.4. Monitoring Compliance

Commented [GB32]: This reflects the recommendations discussed at the April meeting. Update based on modified or additional recommendations

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CWS must monitor and report based on water quality parameters and schedule set by state primacy agency, and use the data for on-going treatment process control (3.4.1)

Violations:
- Failure to monitor as per schedule
- Failure to maintain data, and use in process monitoring (to be evaluated by state during sanitary survey inspections or as state primacy agency requests)
- Failure to report data to state
- *[something similar to the current rule requirement if data indicates that treatment is outside WQP limits]*

Commented [GB33]: Needs further discussion

CWS also must include an offer to customers in all LCR related outreach to conduct a sample, including in all LSL outreach efforts. CWS must also:
- collect sufficient number of samples, either by customer request or utility initiated sampling;
- promptly report the data to the customer, the state and local PH (if above health action level); and
- use the data as part of on-going evaluation of CCT performance, monitoring for changes in lead levels at the tap over time, geographic trends in levels, and interaction with distribution system water quality.

Commented [GB34]: What is sufficient needs further discussion

Violations:
- Failure to offer to sample
- Failure to collect minimum number of required samples *[at specified locations?]* within 3-year window
- Failure to report data to:
  - Household
  - State
  - Local public health agency (if above household action level)
- Failure to provide rule-required information in sampling offer materials, or in household reporting of the data
- Failure to use household tap sampling data in on-going evaluation of CCT and maintain record of having done so, (as determined by state during sanitary survey inspections or as state primacy agency requests)

Commented [GB35]: This reference to a 3-year window is intended to reflect the text above regarding maintaining a floor to the number of tap samples…. "systems should be required to collect no fewer samples in a three year period than they would under the current three-year reduced monitoring requirement"

3.5 Establish a Household Action Level

The current lead action level is based on the 90th percentile of the collected samples. Without a maximum limit, some users may be exposed to levels of lead in the drinking water that presents a potentially significant health threat, especially to children, without exceeding the action level. If the levels are high enough and state and local authorities do not act, EPA could determine that the levels pose "an imminent and substantial endangerment to the health of persons" pursuant to section 1431 of the Safe Drinking Water Act. (40 USC 300i)

3.5.1 Household Action Level Recommendations

To avoid the need to invoke section 1431 of the SDWA, the LCRWG recommends that EPA establish in a revised rule a "household action level" and require the PWS to notify the local health department and state drinking water authority of sample results over that level. The

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requirement would be triggered by any sample results that the PWS receives from a user or from its own monitoring. However, the PWS would not be required to make the notification until it has investigated the sample in a timely manner to eliminate sampling or assay errors. The existing action level would be renamed as a "system action level."

Commented [GB36]: Review rest of document for this term to check for consistency (with what the role of a system action levels ends up being and for terminology)

The existing rule already requires the PWS to notify residents of the results of water system conducted lead sampling. We would anticipate that the PWS would alert the resident to possibility that the health department may be notified when the sample was taken or the resident provided the PWS with the sample results. While this notice may have the unintended consequence of discouraging some customers from testing, it is important for the customer to make an informed choice.

In response to the notification, the PWS and the health department would consider the situation and take action that they deem appropriate (e.g., testing children's blood, recommending a filter, discussing lead service line replacement with the resident or landlord, advising grandparents about risk to visiting children, or continuing to monitor the situation). We anticipate that the health department be the lead agency, and that the rule would not prescribe actions other than notice as the situations are too diverse and complicated for prescription actions. The LCRWG encourages EPA to work with the Centers for Disease Control and Prevention on recommended approaches and make this information available through the clearinghouse discussed in section 4.2.

Commented [GB37]: A member commented that the LCR should include a requirement for remedial action at the home.

This requirement would be somewhat similar to the regulatory approach taken by the Department of Housing and Urban Development which mandates that public housing authorities notify the local health department within five days when it receives information from any source that a child of less than six years of age living in an assisted dwelling unit may have an environmental intervention blood lead level. (24 CFR 35.1225)

Commented [GB38]: A member suggested that the information from the PWS include information the health dept can use in its outreach to residents.

We recommend that EPA set the household action level based on the amount it would take for an infant to have a blood lead level greater than five micrograms per deciliter (µg/dL) based on consumption of infant formula made with water. When a child's blood lead level exceeds five µg/dL, the Centers for Disease Control and Prevention (CDC) recommends that laboratories and health care providers notify local and state health departments and that action be taken to identify and prevent further exposure.[12] While unlikely, if the calculation shows that the household action level is lower than the system action level, EPA would need to reassess the approach.

3.5.2 Household Action Level Compliance

If household sample exceeds the household action level, PWS must promptly notify the household and the local public health agency; certify that this has been done, and maintain records of having done so.

Violations:

- Failure to timely report data to

[12] http://www.cdc.gov/nceh/lead/ACCLPP/blood_lead_levels.htm

- Household
- Local public health agency

- Failure to certify to state that this has been done
- Failure to maintain records of correspondence between CWS and PH

3.6 Establish Separate Monitoring Requirements for Copper

The current LCR does not deal effectively with copper. Generally speaking, the current rule focuses on the health benefits associated with lead risk reduction, with the result that the currently required in-home sampling is often done in locations with old copper that has passivated. Thus, the possibility may be missed that a system's water chemistry could result in copper releases. Further, the current rule does not require public education for copper, which can have broad benefits.

The LCRWG has concluded that the regulatory approach should separate lead and copper risk management, refocusing attention to where there may be a problem with copper without increasing the burden on systems where there is not a problem. This can be achieved in a cost effective manner by targeting copper monitoring requirements to those PWSs where there may be exposures.

Elevated exposures to copper generally result from new copper plumbing[13] where water chemistry is aggressive to copper. It is technically possible to identify water chemistries that are aggressive versus not aggressive to copper. Thus, the LCRWG recommends that the requirements for copper monitoring focus first on sampling for basic finished water quality parameters such as pH and alkalinity in a way that is representative of the distribution system to identify waters that are aggressive to copper. Systems that can demonstrate that their finished waters are not aggressive to copper or that their distribution systems contain no copper should have no further copper monitoring requirements. This could be written into the rule, rather than require a monitoring "waiver."

3.6.1 Copper Recommendations

Further, the LCRWG recommends that the LCR be revised based on the following concepts:

1. Instead of basing action on the results of routine, in-home copper sampling, actions should be based on the aggressiveness of the water to copper. Systems can determine if their water is aggressive to copper by doing WQP monitoring in the distribution system. All PWSs should be assumed to have water that is aggressive to copper unless they demonstrate that it isn't.

2. EPA should develop criteria to define water that is not aggressive to copper for the purpose of establishing whether a system falls into that category (or "bin") for the purposes of the LCR. EPA should consider the accuracy and potential variability of pH and alkalinity monitoring as well as corrosivity to copper in establishing pH and alkalinity ranges. The criteria also should include consideration of passivation time. Examples of bins would be:

    a. if alkalinity is < 35 pH must be > 7.0 (no upper pH limit)
    b. if alkalinity is 36 to 100, pH must be > 7.2
    c. if alkalinity is 101 to 150 , pH must be > 7.5
    d. if alkalinity is 151-250 , pH must be > 8

[13] New copper is generally understood to be up to six months to three years of age.

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3. PWSs can choose one of several approaches to demonstrate that their water is not aggressive to copper:
    a. Conduct water quality parameter monitoring to assess whether their water meets the definition established by EPA.
    b. Conduct copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL). EPA may want to consider:
        i. Limited number of sample sites needed given copper chemistry
        ii. Provision for sample invalidation based on site-specific conditions such as biologically-induced corrosion.
    c. Conduct a pipe loop study to demonstrate the water chemistry is non-aggressive
    d. Change water chemistry to within the range established for non-aggressive water quality
4. PWSs with water **classified as non-aggressive to copper** must continue to demonstrate that the water is non-aggressive. PWS's can choose to:
    a. Maintain those WQPs that demonstrate it maintains non-aggressive water under (2) above.
    b. Conduct copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL)

    PWSs that are not able to maintain their WQPs must implement a public education program as described in the next section.

5. PWS's with water **classified as aggressive to copper** must initiate and maintain a public education program. The public education program must either provide:
    a. Information to all new homes (new construction or change of service) upon initiation of new service

    AND

    b.
        i. Information to newly renovated homes at time of renovation

        OR

        ii. Information to all customers on a routine basis

    In addition, in guidance, EPA should encourage PWSs to notify contractors, plumbing suppliers, and plumbers of copper corrosivity and to work with relevant officials and organizations to consider building codes changes that would prohibit copper piping in new construction if the corrosive water conditions cannot be eliminated. EPA also should provide guidance and/or templates, particularly for small systems, for public education messages and modes of delivery.

6. EPA should consider whether or not CCT should be required for a PWS **classified as aggressive to copper** Not all systems with water aggressive to copper necessarily will have homes with new copper, so treatment might not be necessary or perhaps even advisable, particularly for small systems that can control plumbing materials used or for systems in communities that modify their

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plumbing codes. Passivation time of copper varies considerably, and CCT may not be necessary or advisable when passivation time is short if interim actions to protect public health other than CCT are feasible. In determining when CCT should be required and any associated monitoring requirements, EPA also should take into consideration that a PWS may not have access to information about renovations where new copper has been installed and, even when such information is available, can't control whether the customer will participate in a monitoring program. Setting the correct level and establishing a regulatory approach that triggers CCT only when necessary will require a complex assessment and is beyond the scope of this workgroup.

7. In the revised LCR, systems should continue to be required to notify the primacy agency if they are making any long-term treatment change or addition of a new source. This section of the rule should be made clear that for copper, the system may be required to demonstrate that its finished water continues to be non-aggressive to copper (per 4 above).

8. Additional information needs to be gathered on the current distribution of pH, alkalinity, and phosphate residual among systems nationally to fully understand the implications of this approach.

3.6.2 Copper Compliance

Violations:

- Failure to implement public education, for PWSs that have not demonstrated their water chemistry is not aggressive to copper.
- Failure to maintain a monitoring program representative of the distribution system that demonstrates the system has water chemistry not aggressive to copper.
- Failure to provide notice to and, if required, consultation with the primacy agency, when a PWS makes a significant change in source or treatment (as in the current LCR).
- Failure to implement CCT or other risk reduction actions prior to CCT as determined by the primacy agency.

4 Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water

The LCRWG urges EPA not only to promulgate a revised LCR, but also to play a leadership role in educating, motivating, and supporting the work of other agencies, where EPA does not have the authority to act. The Long Term Revisions to the Lead and Copper Rule (LTR LCR) are very important. However, removing lead from drinking water systems and reducing exposure to lead from drinking water in the meantime will require renewed commitment, cooperation and effort by government at all levels and by the general public.

Specific recommendations for action in addition to the LTR LCR include:
[Note: These items are taken from a variety of sources, are in no particular order, and will be edited after the April discussion.]

- EPA working across all offices to take an integrated approach to action and education on lead from all sources (paint, air, site clean–up, etc.), with proper emphasis on lead in drinking water, especially in relation to the populations most vulnerable to this source (i.e., fetuses and infants dependent on reconstituted formula). For example, OGWDW should coordinate with EPA's lead-based paint program so lead hazards are communicated consistently.

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- Work with other federal agencies including HUD in terms of lead programs, including but not limited to expanding federal funding from those programs to include lead service line replacement; HUD/DOT in terms of efficiency in possible coordination of lead service line replacement with road projects, construction projects; and CDC in terms of childhood lead poisoning prevention, screening, and protection programs

- Enhanced cooperation with state, county, local health departments to promote an integrated approach to childhood lead poisoning screening, prevention, and protection that emphasizes drinking water and its potential as a primary lead source, especially for fetuses and infants dependent on reconstituted formula

- EPA needs to work with agencies at all levels of government to support financial assistance programs for LSL removal. Building costs into a PWS's capital budget planning should also be a consideration.

- EPA should include diverse perspectives in its stakeholder engagement programs, including affected consumers (who should not be required to be members of formal organizations), lead poisoning prevention/clean water advocates, EJ advocates, lead/copper corrosion experts, and representatives from PWSs, States, and federal agencies with Healthy Homes and childhood lead poisoning prevention programs..

- Zoning, including possibility of prohibiting copper plumbing where water is aggressive to copper

- A federal tax deduction to support replacement of the customer portion of LSLs

- State Actions to support customer lead service line replacement, e.g.
    - State legislation requiring inspection or replacement on sale of home
    - Disclosure requirements at sale of home
    - Requirements for LSL removal as part of school and day care licensing
    - Building code requirements for LSL removal upon substantial renovation (could be national action as well)
    - Priority in SRF funding (especially if increased funding is available)

- PWSs should educate (encourage partnerships with?) healthcare providers and health departments even when levels are below the AL.

- Additional technical review (additional study?) is needed on flushing.

5 Conclusion

The LCRWG appreciates the opportunity to provide these recommendations to the NDWAC, offers our thanks to the experts and members of the public who made presentations to the work group, and wishes particularly to acknowledge EPA for the extensive commitment of staff time and expertise to this process.

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ATTACHMENT A

NDWAC Lead and Copper Working Group

Members
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]
Yanna Lambrinidou: Parents for Non-toxic Alternatives
Thomas G. Neltner: National Center for Healthy Housing
John Sasur Jr.: Three Rivers Fire District, Massachusetts
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

DRAFT

Report of the Lead and Copper Rule Working Group
To the National Drinking Water Advisory Council

THIRD~~SECOND~~ DRAFT

[NOTE: THIS DRAFT WAS PREPARED FOR DISCUSSION BY THE LCRWG AT ITS MEETING ON JUNE 24-25~~APRIL 23-24~~, 2015. THIS DRAFT IS BASED ON THE LCRWG'S ~~APRIL 23-24~~FEBRUARY 5-6 MEETING AND INPUT FROM SMALL GROUP CALLS HELD IN MAY~~MARCH~~. IT DOES NOT REFLECT A CONSENSUS OF THE WORKING GROUP. ADDITIONAL EDITS ARE ANTICIPATED.]

MAY~~April~~ 2015

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Appendices

Appendix A – Lead and Copper Working Group Members

Appendix B – Table 21

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Abbreviations

AL – Action Level
ALE – Action Level Exceedance
CCR – Consumer Confidence Report
CCT – Corrosion Control Treatment
EPA – Environmental Protection Agency
LAL – Lead Action Level
LCR – Lead and Copper Rule
LCRWG – Lead and Copper Rule Working Group
LSL – Lead Service Line
LSLR – Lead Service Line Replacement
LTR LCR – Long Term Revisions to the Lead and Copper Rule
MCLG – Maximum Contaminant Level Goal
µg/L – Microgram per Liter
µg/dL – Microgram per deciliter
NDWAC – National Drinking Water Advisory Committee
OGWDW – Office of Ground Water and Drinking Water
OCCT – Optimum Corrosion Control Treatment Technology
OWQP – Optimal Water Quality Parameter
PE – Public Education
pH – Negative log of hydrogen ion molar concentration
PLSLR – Partial Lead Service Line Replacement
POTW – Publicly owned treatment works
POU – Point-of-use treatment device
PWS – Public Water System
SAB – Science Advisory Board
SDWA – Safe Drinking Water Act
SRLF – State Revolving Loan Fund
TT – Treatment Technique
WQP – Water Quality Parameter

DRAFT

Report of the Lead and Copper Rule Working Group to the National Drinking Water Advisory Council

1. Executive Summary

The Lead and Copper Rule Working Group (LCRWG) of the National Drinking Water Advisory Council (NDWAC) has completed its deliberations on issues associated with long term revisions to the Lead and Copper Rule (LCR). This report includes the group's findings and recommendations.

This executive summary provides a brief overview of the report. Details of the findings and recommendations are provided in the body of the report. A list of the members of the working group can be found in Appendix A.

1.1. Charge

The charge to the LCRWG was to provide advice to the NDWAC as it develops recommendations for the U.S. Environmental Protection Agency (EPA) on targeted issues related to long term revisions to the Lead and Copper Rule (LCR) under the Safe Drinking Water Act (SDWA).

1.2. Findings and Recommendations

There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for children and other vulnerable populations with both acute and chronic exposures. The lack of resources to reduce the sources of exposure in some communities also raises important questions of disparate impact and environmental justice. ~~The best way of preventing lead exposure through drinking water is to remove lead from the drinking water system.~~

Specific recommendations of the LCRWG include revisions to the LCR to:

- Require proactive LSL replacement programs and improv~~ed~~ing access to information about LSLS, in place of current requirements in which lead service lines (LSLs) must be replaced only after a lead action level (AL) exceedance and CCT;
- Develop stronger public education requirements for lead and LSLs;
- Strengthen corrosion control treatment (CCT);
- Modify monitoring requirements;
- Establish a health-based, household action level~~substantial and imminent endangerment standard~~; and
- Separate the requirements for copper from those for lead.

The anticipated Long Term Revisions to the Lead and Copper Rule (LTR LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential. However, although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other agencies. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

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~~Although leadership by EPA is essential, reduction of exposure to lead in drinking water can not be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public.~~

~~The best way of preventing lead exposure through drinking water is to remove lead from the drinking water system, the primary source of which are full and partial lead service lines (LSLs) in systems where they continue to be used. Lead also can be found in plumbing materials in residential buildings, schools, office buildings and elsewhere. Although leadership by EPA is essential, reduction of exposure to lead in drinking water can not be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public.~~

2. Considerations and Background Information

~~There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for children and other vulnerable populations with both acute and chronic exposures. The lack of resources to reduce the sources of exposure in some communities also raises important questions of disparate impact and environmental justice.~~

~~The best way of preventing lead exposure through drinking water is to remove lead from the drinking water system, the primary source of which are full and partial lead service lines (LSLs) in systems where they continue to be used. Lead also can be found in plumbing materials in residential buildings, schools, office buildings and elsewhere.~~

2.1. Considerations in Preparing this Report

~~The anticipated Long-Term Revisions to the Lead and Copper Rule (LTR-LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. However, removing lead from drinking water systems also will require renewed commitment, cooperation and effort by government at all levels and by the general public. Creative financing and robust public education also are essential. Thus, this report includes recommendations both for revisions to the LCR and for wider action. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other agencies.~~

The members of the LCRWG brought different perspectives and expertise to the preparation of this report. Although not all members agreed with each and every point below, the LCRWG took one another's perspectives into account and, thus, the following concepts collectively ~~Several foundational concepts~~ underlie the recommendations in this report~~, some of which can be accomplished by public water systems (PWSs) through the LCR and others of which may require non-regulatory action or programs by EPA and others.~~ Additional detail is provided in the recommendations section below.

- There is no safe level of lead. Lead can pose health risks to anyone, but there are heightened risks for children and other vulnerable populations with both acute and chronic exposures.
- ~~As is emphasized above, there is no safe level of lead.~~ Lead-bearing plumbing materials pose a risk at all times (not just when there is a lead action level (LAL) exceedance).
- Effective elimination of lead materials in contact with water and minimization of exposure to lead in drinking water is a shared responsibility. PWSs, consumers, building owners, public health officials and others each have important roles to play.

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- The anticipated Long Term Revisions to the Lead and Copper Rule (LTR LCR) is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. However, additional action beyond the scope of the Safe Drinking Water Act is needed. Removing lead from drinking water systems also will require renewed commitment, cooperation and effort by government at all levels and by the general public. (See Section 5: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

- Proactive action is needed to remove the sources of lead, with appropriate incentives to encourage such action both for (PWSs) and their customers. ~~PWSs should establish lead removal programs with the goal of removing all lead from contact with drinking water over time, with risk reduction measures implemented in the meantime. In addition, stronger action must be taken when lead exposure levels pose a risk of imminent and substantial endangerment to the residents.~~

- Successful implementation of the revised LCR can only take place in the context of a more holistic effort on lead in water issues involving stakeholders other than just EPA and water systems, and resources beyond those able to be brought to bear by water systems. Partnerships at all levels are essential. Recognizing that public agency budgets are tighter than ever, greater engagement by local health agencies, those funding housing programs, and those involved in permitting and construction is particularly important.

- Creative financing mechanisms also will be needed to achieve this goal for all individuals potentially exposed to lead, regardless of race, ethnicity or income. Leaving a lead service line in place because a low-income resident does not have the means to pay raises serious questions of disparate impact and environmental justice ~~concerns. EPA needs to work with agencies at all levels of government to support financial assistance programs for LSL removal. Building costs into a PWS's capital budget planning should also be a consideration.~~

- ~~Enhanced public education must be a priority.~~ The public plays a critical role in protecting their families' health by reducing exposure to lead and copper, and informing the public enables them to be effective participants in implementing their share of the responsibility.

- The characteristics of the issues associated with lead and copper are very different. ~~Thus, the requirements for lead and copper should be separated.~~

- The LCR should remain a treatment technique rule, but it can be improved ~~, e.g. by developing more robust water quality parameter monitoring (WQP) requirements to demonstrate that a PWS's water is non-corrosive and to maintain those conditions.~~

- ~~In-home sampling remains an important part of the LCR, but with a change in its purpose to site assessment sampling to provide information to residents.~~

- Optimum corrosion control treatment (OCCT) is very complex and dynamic, so p~~P~~roviding technical assistance to PWSs is important. ~~, including updating the guidance manual on determining and evaluating OCCT to improve minimization of lead in plumbing systems from all sources.~~

- Attention to unintended consequences is important in complex situations such as the LCR. ~~Examples in this context include considering the impact of phosphate as an OCCT chemical on POTWs and receiving waters and considering the role of OCCT for metals in addition to lead and copper.~~

- Attention to what systems can implement and States are able to oversee and enforce also is important. ~~This may include recognizing the limits to a water system's authority on private property, including issues of access to private property or legal prohibitions against spending~~

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~~public money on private property. It also may require partnering with other entities that have additional roles, such as local government in setting ordinances, local health authorities in providing public education and assistance, and customers in participating in risk reduction efforts.~~

- Reducing complexity by eliminating or modifying requirements that increase system burden without achieving reasonable reduction in lead and/or copper exposure can allow resources to be focused on actions that better achieve health outcomes.

2.2. Historical Trends

Historically, in addition to modern uses in gasoline, food and paint (now generally prohibited as additives in the United States and many other countries) and consumer products, lead was used for water pipes, in lead alloyws (bronze, brass) for plumbing fittings, and in lead solders, in part due to its durability and malleability. In the early twentieth century, lead pipes were replaced by other materials, such as plastics, but existing lead pipes remain in place in many cities and lead alloys continued to be used until very recently.[1]

Progress has been made in reducing the levels of lead in the U.S. population in recent decades, from all sources of exposure. However, at the same time, growing understanding about the public health risks of lead and of what has been learned through implementation of the LCR calls on all involved to rethink efforts to reduce exposure to lead in drinking water.

The U.S. Public Health Service published a non-enforceable standard for lead in 1925, consisting of a tolerance limit (blood lead level or BLL) of 0.1 mg/L.[2] Its successor, the Centers for Disease Control and Prevention, recently redefined the "level of concern" downward to 5 µg/dL (or 0.05 mg/L). The 1986 Safe Drinking Water Act amendments defined "lead-free" plumbing and prohibited the use of plumbing for public water supply that did not meet the new definition. The amendments also required EPA to set standards limiting the concentration of lead in public water systems. EPA first issued the lead and copper rule on June 7, 1991.[3] The latest modification was issued October 10, 2007. Following the adoption of the 1991 rule, public water systems serving more than 50,000 people were required to implement corrosion control, among other requirements. All public water systems had to implement tap sampling, and to take specific actions if samples exceeded an action level. (See Regulatory Background below for additional information on the regulations.)

The Centers for Disease Control and Prevention (CDC) tracks blood lead levels (BLLs) from all sources for the non-institutionalized U.S. population through the National Health and Nutrition Examination Survey (NHANES). The percentage of children ages one through five years with BLLs ≥ 10 µg/dL has decreased over time. (See Table 1.) NHANES data from the 1970s and 1980s also showed disparities by race and income. According to a 2012 assessment published in CDC's *Morbidity and Mortality Weekly Report,* "By the 1999-2004 surveys, the percent differences in BLLs ≥ 10 µg/dL for children aged 1-5

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[1] *Check reference* Safe Drinking Water Act Amendments of 1986. "Prohibition on use of lead pipes, solder, and flux." [HYPERLINK "http://en.wikipedia.org/wiki/Title_42_of_the_United_States_Code" \o "Title 42 of the United States Code"] [HYPERLINK "http://www.law.cornell.edu/uscode/42/300g-6(d).html"]. [HYPERLINK "http://legislink.org/us/pl-99-359"], approved 1986-06-19.

[2] U.S. Public Health Service, Washington, DC (1925). "Report of the Advisory Committee on Official Water Standards." Public Health Rept. 40:693. April 10, 1925.

[3] EPA. "Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Final Rule." *Federal Register,* 56 [HYPERLINK "http://en.wikipedia.org/wiki/Federal_Register" \o "Federal Register"] 26460, 1991-06-07. 40 CFR Part 141, Subpart I.

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years, by race and family income, were no longer statistically significant…"[4] It is beyond the scope of this report to attribute this trend to specific sources of exposure.

TABLE 1. Blood lead levels (BLLs) of children aged 1–5 years — National Health and Nutrition Examination Survey, United States, selected years

Year	% with BLL ≥10 µg/dL	Geometric mean BLL (µg/dL)
1976–1980	88.2	15.0
1991–1994	4.4	2.7
1999–2002	1.6	1.9

"Interpreting and Managing Blood Lead Levels <10 µg/dL in Children and Reducing Childhood Exposures to Lead" Recommendations of CDC's Advisory Committee on Childhood Lead Poisoning Prevention, MMWR, November 2, 2007 / 56(RR08);1-14;16

EPA LCR compliance monitoring data[5] also show a downward trend in the 90th percentile lead concentrations. A comparison of initial compliance monitoring by systems serving more than 50,000 persons conducted from 1992-93 with post-2000 compliance monitoring data found a decrease in lead action level exceedances. After 2000, 17 systems serving more than 50,000 persons had 90th percentile lead concentrations greater than 15 µg/L, compared to 177 systems of that size in 1992-93.[6]

[insert paragraphic about corresponding downward trend in levels of concern]

Commented [GB1]: Nse and Tom

Thus~~However~~, efforts to reduce lead exposure further, including from drinking water, remain important if society is to achieve a lasting solution to lead exposure from all sources and the resulting protection of public health. For example, recent studies suggest that there can be unanticipated spikes in lead releases in drinking water, often related to particulate releases. Often the lap~~compliance~~ sampling program missed these spikes because they missed the contribution from the lead service line.[7] Further, LCR compliance data does not show a correlation between lead action level exceedances and water quality parameter violations.[8] Thus, it is reasonable to conclude that corrosion control is an important tool but is not sufficient to prevent high levels of lead from getting into drinking water, particularly from the lead service lines.

Copper is a common material used in household plumbing and drinking water service lines in the United States. Copper is an essential nutrient in small amounts; however, acute ingestion of excess copper in drinking water has been associated with adverse health effects, including acute gastrointestinal symptoms such as abdominal discomfort, nausea, and vomiting.

[4] Brown M and S Margolis, "Lead in Drinking Water and Human Blood Lead Levels in the United States" (2012, MMWR)

[5] U.S. Environmental Protection Agency. 2006. Summary: Lead Action Level Exceedances for Medium (3,300-50,000) and Large (greater than 50,000) Public Water Systems. (updated as of June 1, 2004)

[6] Brown et al "Strategies for assessing optimized corrosion control treatment of lead and copper" Journal AWWA 105:5 May 2013

[7] *Check reference* - Schock M *[insert title and date of webinar presentation]*

[8] *Check reference* - EPA data provided to the LCRWG.

The SDWA requires EPA to set MCLGs at concentration levels at which no known or anticipated adverse effects would occur, allowing for an adequate margin of safety. EPA proposed an MCLG of 1.3 mg/l for copper in 1985, and finalized that MCLG in 1991 when the LCR was promulgated. The LCR set the action level (AL) for copper, the level at which treatment technique actions are triggered for the water system, equal to the MCLG. The AL is triggered if 90th percentile level of water samples is exceeded. All community water systems must report the 90th percentile level and the number of samples that exceeded the 90th percentile in their Consumer Confidence Reports.

2.3 Regulatory Background and Formation of the NDWAC Lead and Copper Work Group

Under the Safe Drinking Water Act (SDWA) EPA sets public health goals and enforceable standards for drinking water quality.[9] The Lead and Copper Rule (LCR) is a treatment technique rule. Instead of setting a maximum contaminant level (MCL) for lead or copper, the rule requires (PWSs) to take certain actions to minimize lead and copper in drinking water, to reduce water corrosivity and prevent the leaching of these metals from the premise plumbing and drinking water distribution system components and when that isn't enough, to replace lead service lines under their control. The current rule sets an action level (AL), or concentration, of 0.015 mg/L for lead and 1.3 mg/L for copper. An AL is not the same as an MCL. An MCL is based on health effects and feasibility; whereas an action level is a screening tool for determining when certain treatment technique actions are needed.

The LCR action level is based on the practical feasibility of reducing lead through controlling corrosion. In the LCR, if the AL is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the AL), it is not a violation, but triggers other requirements that include water quality parameter monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education, and lead service line replacement (LSLR). The rule also requires States to report the 90th percentile for lead concentrations to EPA's Safe Drinking Water Information System (SDWIS) database for all water systems serving ~~more than~~ 3,300 or more persons, and for those systems serving fewer than 3,300 persons only when the lead action level (LAL) is exceeded. States only report the 90th percentile for copper concentrations in SDWIS when the copper action level is exceeded in water systems regardless of the size of the service population. Public education requirements ensure that drinking water consumers receive meaningful, timely, and useful information that is needed to help them limit their exposure to lead in drinking water.

In early 2004, EPA began a wide-ranging review of the implementation of the LCR to determine if there was a national problem related to elevated levels of lead in drinking water. As part of its national review, EPA collected and analyzed lead concentration data and other information, carried out a review of implementation in States, held four expert workshops to discuss elements of the regulations, and worked to understand local and State efforts to monitor for lead in school drinking water, including a national meeting to discuss challenges and needs. EPA released a Drinking Water Lead Reduction Plan (DWLRP) in March 2005. This plan outlined short-term and long-term goals for improving implementation of the LCR. The plan can be found at the following web address: [HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_review.cfm"]

In 2007, EPA promulgated regulations, which addressed the short-term revisions to the LCR that were identified in the 2005 DWLRP. These requirements enhanced the implementation of the LCR in the areas

[9] EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

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of monitoring, treatment, LSLR, public education, and customer awareness. These revisions better ensured drinking water consumers receive meaningful, timely, and useful information needed to help them limit their exposure to lead in drinking water.

A number of Safe Drinking Water Act (SDWA) amendments aim to reduce lead in drinking water by limiting the amount of allowable lead in plumbing materials that come into contact with drinking water. In 1986, the SDWA was amended to prohibit the "use of any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, in the installation or repair of (i) any public water system; or (ii) any plumbing in a residential or non-residential facility providing water for human consumption, that is not lead free". Lead Free was defined as solder and flux with no more than 0.2% lead and pipes with no more than 8% lead.

Congress again amended the SDWA in 1996, to prohibit the introduction into commerce of any pipe, pipe or plumbing fitting or fixture that is not lead free and to also require pipes, pipe or plumbing fittings or fixtures be in compliance with 3rd party lead leaching standards. These provisions ensure that only products meeting the lead free definition are sold in the U.S. and that pipes, pipe or plumbing fittings or fixtures are certified to be lead free.

The Reduction of Lead in Drinking Water Act of 2011 revised the maximum allowable lead content from not more than 8% to not more than a weighted average of 0.25% lead and included a calculation procedure for determining the weighted average; further reducing the amount of lead in contact with drinking water. It also eliminates the federal requirement to comply with the lead leaching standard and included exemptions from the lead free definition for plumbing devices that are used exclusively for non-potable services and also for specific plumbing devices such as toilets, bidets and urinals. The Community Fire Safety Act of 2013 further amended SDWA to add fire hydrants to the list of exempted plumbing devices.

EPA has continued to work on the long-term issues that required additional data collection, research, analysis, and full stakeholder involvement, which were identified in the 2005 DWLRP and the 2007 rule revisions. This action is referred to as the LCR Long-term Revisions (LTR). The LCR LTR would apply to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). In this report, the term public water system (PWSs) is meant to refer to both of these categories but not to transient non-community water systems.

Seeing the need for additional input on potential revisions to the Lead and Copper Rule, EPA requested that the National Drinking Water Advisory Committee (NDWAC) form the Lead and Copper Rule Working Group (LCRWG) to consider several key questions for the LCR LTR, taking into consideration previous input. The LCRWG met ~~seven~~six times in 2014 and 2015 to produce this report, and sought input from the NDWAC in advance of the last meeting to understand and address questions the NDWAC might have about the working group's recommendations. ~~in which it provides recommendations on the LCR LTR.~~

A list of members of the working group is provided in Appendix A. [*add following approval*...This report was approved by consensus of the LCRWG.]

3. Recommendations for Revisions to the Lead and Copper Rule

The anticipated long term revisions to the LCR is a very important opportunity for removing sources of lead in contact with drinking water and for reducing exposure to lead from drinking water in the meantime. Creative financing and robust public education also are essential.

The LCRWG offers the following recommendations, based on information provided to the work group and on the work group's own deliberations. The LCRWG considers these recommendations to be an integrated package, not a menu of choices from which some recommendations can be selected and combined with others. This package reflects a concerted attempt to strengthen public health protection, which includes targeting the resources available to PWSs for the greatest public health value. While individual members might differ on specific recommendations, it is the consensus of the work group that this package of recommendations constitutes an improvement over the current LCR.

Commented [GB2]: This question will be asked again at the June meeting.

The diagram on the following page illustrates the conceptual framework of the recommendations that follow.

The LCRWG specifically recommends that EPA revise the LCR to:

- Require proactive LSL replacement programs and improve access to information about LSLS, in place of current requirements in which lead service lines (LSLs) must be replaced only after a lead action level (AL) exceedance and CCT;
- Develop stronger public education requirements for lead and LSLs;
- Strengthen corrosion control treatment (CCT);
- Modify monitoring requirements;
- Establish a health-based, household action level ~~substantial and imminent endangerment standard~~; and
- Separate the requirements for copper from those for lead.

However, although leadership by EPA is essential, reduction of exposure to lead in drinking water cannot be achieved by EPA regulation alone. Thus, this report also includes recommendations for renewed commitment, cooperation and effort by government at all levels and by the general public. We urge EPA to play a leadership role not only in the revisions to the LCR but also in educating, motivating, and supporting the work of other agencies. (See Section 4: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water.)

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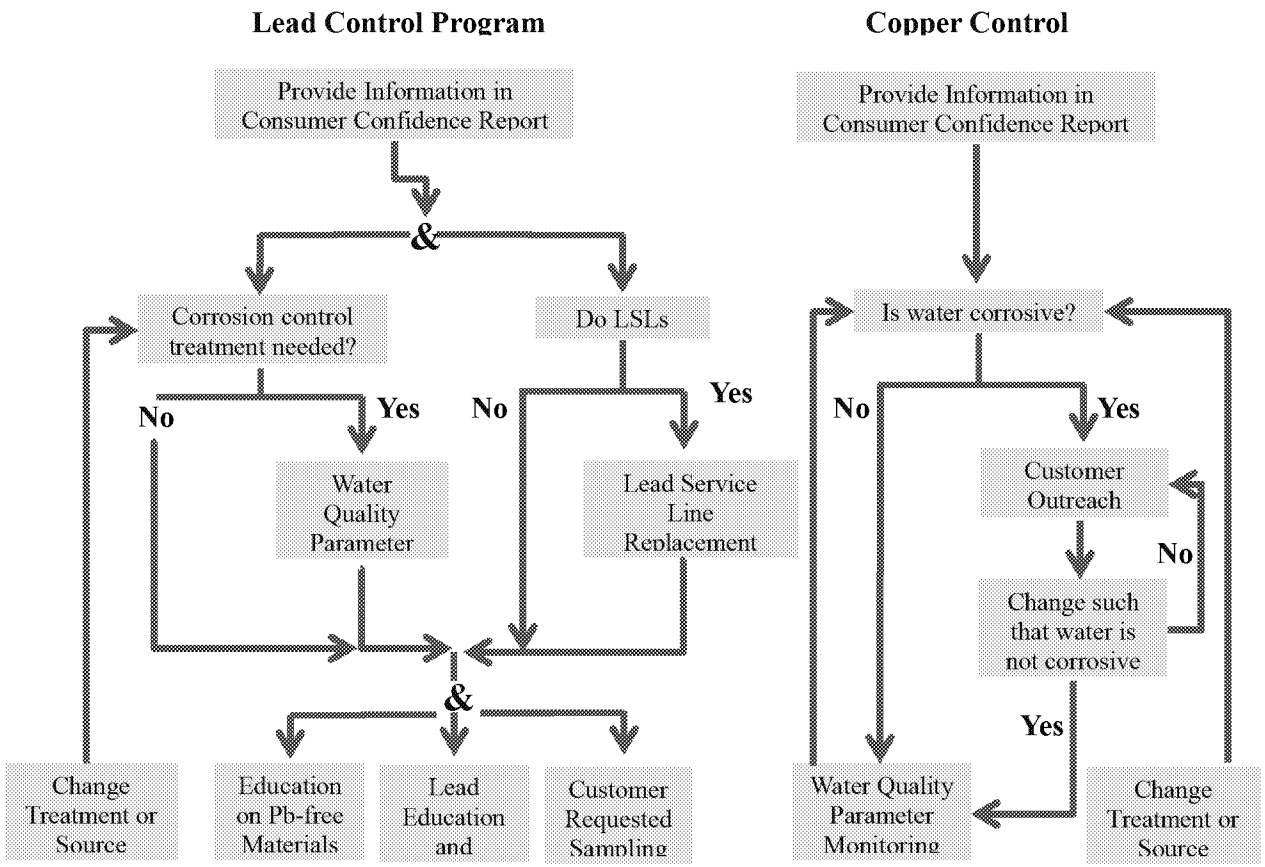
Commented [GB3]: This is a first draft. PE recommendations are missing. Other comments welcome.

Overview of Recommended LT-LCR Framework



2.3.3.1 Replace Lead Service Lines

Commented [GB4]: A member asked that there be a definition of a lead service line.

Need also to find a location for clarity that the goal is full LSLR not partial.

Removing the sources of lead in drinking water should be a national goal. More proactive action than has taken place to date is needed to achieve it.

Although success in achieving this goal will require a concerted effort by many and can not be accomplished solely through the authorities provided under the Safe Drinking Water Act, revisions to the Lead and Copper Rule are an important component to achieving this goal and should be structured accordingly. [See Section 4the Addendum to this report for recommendations that complement revisions to the LCR.]

The existing LCR has not been as successful as originally envisioned at creatcding sufficient incentives to fully replace LSLs and other sources of lead, (such as from premise plumbing), because replacementit is only required when the lead AL has been exceeded and optimizing CCT is insufficient to bring a system back under the action level. Systems that do not exceed the lead Al will never have to implement a LSL replacement program. Further, the link to action level exceedance does not allow adequate time for a well-planned LSLR program, and a significant unintended consequence where systems have had to implement a LSL replacement program quickly has been an increase in partial LSL replacement.

EPA asked the Science Advisory Board (SAB) to evaluate the current scientific data regarding the effectiveness of PLSLR and the review centered around five issues: (1) associations between PLSLR and blood lead levels in children; (2) lead tap water sampling data before and after PLSLR; (3) comparisons between partial and full LSLR; (4) PLSLR techniques; and (5) the impact of galvanic corrosion. The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of PLSLR in reducing drinking water lead concentrations. The small number of studies available had major limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating PLSLR efficacy.

While recognizing the limits to current data, the SAB concluded that PLSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months, and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to increase then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR. The SAB also concluded that in studies comparing full LSLR versus PLSLR, the evaluation periods were too short to fully assess differential reductions in drinking water lead levels. However, the SAB explained that full LSLR appears generally effective in reliable achieving long-term reductions in drinking water lead levels, unlike PLSLR. Both full LSLR and PLSLR generally result in elevated lead levels for a variable period of time after replacement. The limited evidence available suggests that the duration and magnitude of the elevations may be greater with PLSLR than full LSLR.

Taking all of these considerations into account, the LCRWG has concluded that an effective framework for replacement of LSLs would include the following and the LCR should be revised accordingly:

- Requiring all PWSs establish a LSL replacement program unless they can demonstrate that LSLs are not present in their system;

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- Clear guidance, case studies, and templates for LSL replacement programs, including a toolkit of ideas for creative funding strategies;
- Targeted outreach to customers with LSLs;
- Dates by which systems should have begun and completed replacement of all LSLs and PSLSs, without penalty to PWSs for those homeowners who refuse to participate in the replacement program as long as the PWS has made a meaningful effort to work with such a homeowner;
- Understanding where LSLs and PLSLs exist, while making action on replacement the priority;
- Programs in place addressing operations that disturb LSLs, educate consumers, and provide voluntary sampling of consumer taps; and
- Avoiding the time and expense of upfront plan approval and using simplified reporting to the states so they would only need to intervene when problems arise.

~~2.3.1.3~~ 1.1 Update inventories and improve access to information about lead service lines

Updating and improving access to information about the location of both full and partial lead service lines is both essential to ensuring LSLs are replaced and important for successful, proactive outreach to customers who are most likely to have a LSL.

The LCRWG recommends combining:

1) The presumption that a service line put in place prior to the date when lead service lines were prohibited has lead materials unless the PWS has information to show that it not, with

2) Providing credit to a PWS toward its replacement goals for demonstrating that a LSL does not have lead materials.

This approach is intended to create incentives for prompt action to develop an accurate inventory of LSLs and PLSLs, time to organize an effective replacement program, and an opportunity to take action to replace LSLs rather than devoting time and resources on planning documents that must be approved by the primacy agency.

The LCRWG recognizes that PWSs vary in the amount of information they have about the location of full and partial LSLs.

In addition, the LCRWG recommends that all PWSs should establish a clear mechanism for customers to access information on LSL locations (at a minimum). Detailed public education recommendations for both lead and copper follow in separate sections. With respect to information about LSLs, PWSs should:

- Have outreach materials that indicate that property specific information is available.
- Inform customers who may have LSLs about the risks of partial line replacement, who is responsible for replacing the service line, and the legal basis of that determination.
- Provide information it has about LSLs to existing home owners and residents on request.
- Provide information to realtors, home inspectors, and potential home buyers on request
- Communicate that this information is subject to disclaimer for accuracy based on information available to utility.
- Develop a system to track LSL replacement from PWS.

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Where a service line serves multiple dwellings or places such as schools or child care centers that have many children, EPA should establish a formula for giving an extra weight or numerical count to these lines in the initial inventory to recognize the additional children that would be affected.

~~2.3.2.3~~ 1.2 Establish active LSL replacement programs

Proactive LSL replacement programs are key to moving to a future in which lead is not in contact with drinking water. To accomplish this, the LCRWG recommends replacing the current regulations, in which LSL replacement is required only if a PWS has a lead AL exceedance and after the PWS takes action to optimize CCT, because this has not resulted in the complete replacement of many LSLs across the country.

Commented [GB5]: Question from a member: is there data on how many existed when the LCR was first promulgated and how many exist now?

Instead, a revised LCR should include a direct requirement that all PWSs with lead service lines prepare and implement a LSL replacement program, along with a combination of changes to the regulatory approach described in this report and supportive actions by other public and private agencies, customers and other stakeholders. Taking this approach has the advantages of making replacement of LSLs something all systems do and of establishing programs that are put in place in an organized and measured way.

Supportive actions include increased funding of federal lead risk reduction programs under the Department of Housing and Urban Development (HUD) to help fund customer-owned portions of LSLs and to consider federal tax deductions for this purpose. Additionally, states should pass legislation requiring inspection, disclosure and/or replacement of LSLs on sale of property, ~~and especially~~ when lines have been disturbed as part of a renovation. Details on these and other ideas are included in Section 4 of this report ~~the Addendum~~.

The LCRWG recommends that EPA include the following revisions to the LCR:

1. *Goal:* Require PWSs to work with their customers to replace all lead service lines in their service areas within [20] years of the effective date of the rule. The LCRWG urges PWSs work with their customers to replace LSLs in their service areas more quickly, but recognizes in recommending this timeframe that a mandatory LSLR program adds a new and potentially costly requirement for utilities with LSLs who currently are not and may not ever be triggered into a LSLR program under the current rule.

2. *Interim Milestones:* PWSs that identify LSLs in their inventory should be required to perform targeted outreach aimed at replacement of that ~~the~~ inventory of LSLs according to a sequence of three-year milestones,[10] beginning 36 months after the effective date of a revised LCR. Milestones would be set at a faster pace in earlier years and would recognize progress may be more difficult to achieve in later years with those LSLs that remain at that time. Table 2~~1~~ provides an illustration of this concept. PWSs are encouraged to contact a larger number of homeowners than needed for compliance, since some homeowners may fail to reply or may refuse to participate.

Commented [GB6]: See separate document for Table 2.

3. *Replacement Credit:* The following actions can be counted toward the cumulative replacement requirement:

[10] Three years is a standard reporting timetable for drinking water regulations.

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- Full LSL removal
- Confirmation that an LSL included in the initial inventory is not lead.

PLSLR will not be counted toward this requirement. Lack of response or refusal to participate by the customer also will not count toward replacement milestones.

4. *Targeted Outreach*: EPA should create a checklist in the rule of approved outreach methods for contacting customers with LSLs and inviting them to participate in the utility's LSLR program. EPA also should provide guidance and/or templates for these methods to encourage best practices in customer communication. For compliance purposes, the revised LCR should require that a PWS individually notify customers with LSLs describing the risks of lead in drinking water, specifically inviting them to participate in the LSLR program, and clearly describing the terms of the program, and how to follow up. If the customer does not respond or chooses not to participate, the PWS must follow up with another invitation at least every three years and always when there is a new customer at that address.

5. *Control and Responsibility:* The revised LCR should require PWSs to clearly state how the PWS defines ownership of LSLs, who has what financial responsibility for the replacement, what the legal basis is for that determination and any financial assistance programs that may be available.

6. *Planning and Funding Options:* EPA should provide a template and guidance for planning LSL replacement programs, including reference to options to assist customers replace their portion of lead service lines. Small systems may wish to refer to a national information source, such as one provided by EPA; large systems may wish to tailor such information to their circumstances. Financial assistance and affordability options EPA may want to describe in guidance and PWSs could consider include but are not limited to:

Commented [GB7]: Draft language provided by Bob Steidel per assignment at April LCRWG meeting

   a. Rate design considerations
      i. Low rates for low volumes
      ii. Household size-based rates
   b. Non-rate policies
      i. Budget billing
      ii. Fixture retrofits and plumbing assistance by the PWS
      iii. Service line replacement and insurance programs not provided by PWS
      iv. Direct assistance, emergency bill payment relationships
      v. Fixture retrofits and plumbing assistance by NGO organizations providing affordable housing
      vi. Subsidies including LSL / connection replacement costs associated with street, sidewalk, and other repairs not related to drinking water infrastructure
      vii. On-bill financing provided by the PWS
   c. Funding guidance
      i. EPA's Financing for Environmental Compliance – Water
      ii. Tools for Financing Water Infrastructure
   d. Funding sources beyond rate revenue:
      i. EPA's Drinking Water State Revolving Loan Fund (SLRF)
      ii. USDA's Water and Environmental Programs, U.S. Department of Agriculture, Rural Development
      iii. HUD's Community Development Block Grant Program – U.S. Department of Housing and Urban Development
      iv. EPA Targeted Grants to Reduce Childhood Lead Poisoning
      v. HUD Healthy Homes Technical Studies

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vi. HUD Office Healthy Homes and Lead Hazard Control Lead Hazard Reduction Demonstration Program
vii. HUD Health Homes Initiative Lead Elimination Action Program
viii. HUD Office of Healthy Homes and Lead Hazard Control Lead Hazard Control Lead Technical Studies Grant Program

- ~~Adapt low-income assistance programs for plumbing improvements.~~
- ~~Adapt service line insurance programs *[clarify what this is]*~~
- ~~Adapt emergency bill payment relationships with community NGOs.~~
- ~~Identify plumbers with appropriate training and potential provide a community-based reduced rate for LSLR.~~
- ~~Community absorbing additional costs associated with street, sidewalk, and other repairs that might otherwise be shared with homeowner.~~
- ~~Zero or low interest loans paid through water bill.~~
- ~~Others as appropriate given local institutional arrangements.~~

The LCRWG recommends that:

- EPA clearly state the prioritization of LSL replacement within the planning priorities of the drinking water infrastructure needs as a subcategory of transmission and distribution.
- EPA seek an increase of approximately $10 million to the base Drinking Water SRLF appropriation (approximately 0.5% of the current allotment received by the top 15 states) each year of the first three years after adoption of the revised LCR, reserving those funds for PWSs to use for LSL replacement pilot programs to place into operation the funding alternative methods also being recommended to EPA. Those pilot programs would further refine current recommendations and develop new methods of service delivery for LSL / connection replacement.
- Regardless of the programs the PWS is required to create to work with customers to replace LSL / connections, a recommendation to EPA is prior to implementation of a new mandate from a changed LCR to replace LSL / connections, the PWS determine the affordability for the customers within their service area. PWSs may use methodology from Manual M1 (Principles of Water Rates, Fees, and Charges Rate Manual) or Rattelis (Water and Wastewater Finance and Pricing, 4th Edition 2015) or a combination of both, and that the method used determines household relative affordability ILPA (National Drinking Water Advisory Council 2003). The governing board of the PWS will adopt household relative affordability as policy and if the PWS rates applied to the customers exceed that adopted policy, the prioritization of needs and expense will be funded as determined by that governing board.

Commented [GB8]: Bob S will have a handout at the meeting to clarify these suggested recommendations

~~6.~~7. *Operations and Customer Engagement:* EPA also should provide guidance on PWS policies and procedures for how to engage customers in full lead service line replacement and to inform them on appropriate risk reduction measures. PWSs should adopt templates provided in guidance by EPA or, for larger systems, their own standard operating procedures (SOPs) and make them available to their customers and the primacy agency for:

a) planned capital projects that would require:
   - Prior notification (e.g., 45 days prior to planned main replacement or repair) - Contact letter to affected households likely to have lead service lines, providing

information about lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
    - Reminder of flushing post LSLR (e.g., 48 hours prior to actual field work affecting structure) -- Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

b) emergency main and service line repairs that would define how to manage potential disturbance to LSLs safely:
    - Direction to information on lead service lines, associated risk, risk reduction options, and full-lead service line replacement options.
    - Door hanger (or alternative direct contact) with information on flushing and POU devices immediately after lead service line replacement.

c) flushing of service lines after lead service line replacement:
    - flush outside hose bib
    - Initial flush followed by house flush by homeowner or plumber using multiple taps to maximize water velocity
    - Proper use of filters when lead levels might be high

d) Activities of other utilities (e.g. power, cable) when those latter utilities are engaged in construction that affects water service lines or water mains to:
    - Provide information to the other utility about how to manage potential disturbances safely
    - Alert affected residents to information on flushing and the proper use of filters when lead levels might be high

Commented [GB9]: Needs further discussion about what a PWS can be expected to know. Also, a member asked, What should be required and what should be in guidance?

7.8 A revised LCR also should include the following requirements for individual structures or campuses of buildings that are "public water systems" and own their own pipes.

- Non-community water systems with lead service lines should replace lead piping within xx years of the effective date of the revised LCR.
- Individual businesses, nonprofit organizations, and governmental buildings or campuses that are operated as "public water systems" (e.g., hospitals, churches, schools, jails, etc.) should replace LSL lead piping within xx years of the effective date of the revised LCR.

Commented [GB10]: Clarify how these bullets differ

Commented [GB11]: Timing?

The LCRWG discussed and agreed that EPA guidance should encourage PWSs to make every effort to ensure that LSL replacement provides equal protection to low income customers (or rental units with low income residents), people of color and others protected by civil rights law and policy. Environmental justice and civil rights considerations are particularly important in those jurisdictions where the PWS requires the property owner to pay a share of the costs of removing the LSL. Making environmental justice a priority can be achieved through creative funding programs for low-income customers and setting priorities for which neighborhoods are targeting first for LSLR to ensure equal treatment of low income neighborhoods.

The LCRWG also discussed but did not agree that the definition of control as ownership should be changed in the revised LCR. In the current lead and copper rule, when a system exceeds the LAL, EPA requires water systems to replace only that portion of the LSL that it owns. This is based on EPA's current interpretation of the term "control" in the definition of public water system as limited to ownership. Some members of the LCRWG urged that the current definition of control as "ownership"

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should be replaced with a requirement that PWSs must replace the entire LSL, where they have the authority to "replace, repair, or maintain" the line or where they have other forms of authority over the LSL. However, the LCRWG also recognized that some utilities are prevented by law from spending public funds on private property and that gaining physical access to private property poses significant legal issues when a property owner objects.

The LCRWG does agree that the revised LCR should require PWSs to inform customers about the scope of their responsibility and the legal basis for that decision.

3.1.3 LSL Compliance

3.1.3.a LSL Replacement Compliance

Recordkeeping:

- Inventory of LSLs

Reporting: At the end of each three year period, each PWS must provide to the state primacy agency:

- Certification of the outreach conducted (see above for outreach requirements);
- Report on the change in the number of LSL removed from the inventory with better information;
- Report on the number of full LSL removed; and
- Report on locations where the utility-side LSL was removed, but the homeowner refused to replace private portion

Violations:

- Failure to conduct required outreach;
- Failure to step up intensity of outreach if 3-year LSL target has not been met;
- Failure to provide ongoing outreach (at least every 3 years) to locations with partial LSL;
- Outreach materials do not meet the content requirements of the rule

3.1.3.b Operations and Customer Engagement Compliance

CWS must maintain records of who was notified, when notice was given, and content of notice for each capital project. (for 7a and 7b)

Violations:

- Lack of timely notice to customer that LSL removal is scheduled
- Notice materials do not meet rule content requirements

CWS also must develop SOP, and maintain records that it was provided to all utilities conducting activities which may impact LSL (for 7d)

Violation:

- CWS has not developed an SOP (or adopted an SOP template available on the National Clearinghouse) or not provided it to other utilities

Commented [GB12]: How complete do the compliance sections need to be? Would the LCRWG want (or not) to characterize them as a starting point, with the suggestion that EPA review the recommendations above to check if anything is missing?

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Commented [GB13]: Check for what the recommendations say about requirements to notify the homeowner before a partial LSLR is performed.

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3.2 Develop Stronger Public Education Requirements and Programs for Lead and LSLs

Given the public's role in the shared responsibility nature of the LCR, notifying and educating the public about lead in drinking water is very important for real risk reduction. Public education about the risks of lead in drinking water also is important regardless of whether LSLs are present, since lead can be present in other premise plumbing materials. Moreover, targeted outreach is a key to the success of LSL removal programs. The current LCR does not adequately focus on creating on-going opportunities to educate customers on the risks of LSLs or on opportunities to replace them, especially when action is most likely, e.g. at the sale of a home.

The objectives of public education programs should include consumer understanding of: 1) the risks of lead in drinking water; 2) the likelihood that the water in one's home may contain lead; 3) the LCR as a "shared responsibility" rule; and 4) the availability of additional resources that consumers can use to better minimize their exposure to lead.

Although the LCRWG was briefed on and has experience with public education requirements and practices, it does not include members whose specific area of expertise is consumer-centered risk communication. Thus, the LCRWG generally recommends that public education programs for lead should move away from past practices of one-way communication from "experts" to the "public" toward newer concepts of risk communication that involve sustained, multiple, two-way channels of ongoing communication and partnership with the public.[11] EPA should consult with those with such expertise and encourage and apply best practices in effective ways to communicate with the public.

Communication in languages appropriate to the demographics of the community, in clear terms understandable by the public, and with engaging, reader-friendly graphics, photos, and video all help achieve greater understanding. Outreach programs and materials can be improved by involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies. This information can and should be conveyed in different ways and through different communication channels, tailored to the specific circumstances.

Thus, with these and other considerations in mind, the LCRWG recommends that EPA, in consultation with the aforementioned stakeholders and drawing on principles of consumer-centered risk communication:

- Establish an easily accessible, national clearinghouse of information about lead in drinking water to serve the needs of the public and of public water systems (section 3.2.1).

[11] Resources include: 1) EPA's "Risk Communication in Action" ([HYPERLINK "http://nepis.epa.gov/Adobe/PDF/60000I2U.pdf" \t "_blank"]) ; 2) EPA's "7 Cardinal Rules of Risk Communication" ([HYPERLINK "http://www.wvdhhr.org/bphtraining/courses/cdcynergy/content/activeinformation/resources/epa_seven_cardinal_rules.pdf"]); and 3) Education & Communication WG Report 2010; National Conversation on Public Health and Chemical Exposures ([HYPERLINK "http://www.resolv.org/site-nationalconversation/files/2011/02/Education_and_Communication_Final_Report.pdf"])

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- Revise the current CCR language to address lead service lines and update the health statements (section 3.2.2).
- Add requirements for targeted outreach to customers with lead service lines (section 3.1.1 and 3.2.3).
- Strengthen requirements for public access to information about lead service lines, tap monitoring results, and other relevant information (section 3.2.3).

In addition, the LCRWG recommends that EPA consult with the aforementioned experts and stakeholders about methods that would increase public awareness of and motivation to learn about the effects of lead in drinking water and the benefits of removing these materials and/or taking regular precautions when cooking or drinking, regardless of whether LSLs are present or there has been a lead AL exceedance. Based on this advice, EPA should take small systems into account and also consider whether such methods should be included in guidance or in revisions to the LCR.

3.2.1 National Clearinghouse~~Information Resource~~ About Lead in Drinking Water

The LCRWG recommends that EPA take the lead, working with other partners to establish a national, accessible information clearinghouse~~resource~~. The LCRWG suggests that this information clearinghouse include a website, that the materials on the web site be accessible for distribution through the Safe Drinking Water Hotline for those who may not have internet access, and that EPA investigate and apply newer communication technologies and ideas for interactive or other innovative means of communication with the public about lead in drinking water (e.g. social media methods and outreach programs). The clearinghouse should include information in multiple languages, in clear terms understandable by the public, and should include engaging, reader-friendly graphics, photos, and video. In developing this clearinghouse, EPA is encouraged to consult people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies.

Such a clearinghouse~~resource~~ would be intended for use by the general public, PWS's, public health agencies, and health professionals.

- It should include information and educational materials for the public that the public could access directly and that PWSs could use to meet many of the public education requirements of the LCR.
- It also would include guidance and templates, particularly for small systems, on SOPs for compliance with the LCR (e.g. templates for communicating lead monitoring results to individual customers, template for explaining to customers how to obtain information on whether their service line could be lead, etc).
- Principles and guidelines for best practices in public education would be important for developing the content of the materials.
- Case examples of how communities have been successful in lead inventory updates and removal programs, information about funding sources, and contacts to other relevant agencies also should be included.
- ~~3.~~ Further, EPA should consider best practices in methods for achieving greater public awareness of ~~branding~~ the clearinghouse so that it reaches as many people as possible.

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The web site should include the following information:

Health risks

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- Clear and prominent statement that no level of lead in drinking water is safe for human consumption and that a short-term exposure to a young child can result in permanent harm to the brain if the levels are high enough.
- Clear and distinct language on the health risks of consuming lead in drinking water
- Identification of the most vulnerable populations
- Importance of drinking water plumbing as a lead source
- How to have BLLs checked and limitations of testing
- How to have water tested and limitations of testing
- List of labs for testing water other than the utility and what to ask for in terms of number and size of bottles, diameter of mouth of bottles, analysis that measures lead particles, etc.

Commented [GB14]: A member asked whether this could this be elaborated to convey that lead particles can have high potency (e.g. exceeding the CPSC standard used to recall toys) and that the risk of exposure should be taken seriously.

Forms of lead in water and health risk implications

- Soluble
- Particulate
- Unpredictability of lead release

Sources of lead in drinking water

- LSLs
- Other lead-bearing plumbing
- Scale on internal plumbing that can be a source of lead from present or past LSLs

Identification of service line material

- How to recognize a pipe that is made of lead (and when not to check due to age of home)
- What to do about galvanized pipe and why it is a potential source of lead

For homes with LSL

- LSL ownership
- Difference between full and partial lead service line replacement (physically and in terms of health risks)
- Benefits to full LSL replacement
- Actions to take if you have a partially replaced LSL
- Available methods for LSL removal
- Opportunities for removal, approximate cost, and financing options
- Overall benefits to the community of removing LSLs fully (lower treatment costs, better community health, environmental, etc.)
- Where applicable, requirements for notification during real estate transfer or new rental

Health-protective actions

- Precautionary water-use practices
- Role of filters and proper maintenance of them if they are used
- Replacement of leaded plumbing with lead-free plumbing

Additional information

- How to contact your utility and request a LSL inspection and/or water test
- Where applicable, reference to utility-specific website with local lead-related documents and data (e.g. Consumer Confidence Reports (CCRs), sampling protocol used for LCR compliance, lead-in-water test results, etc.)
- What you need to know about lead in water in schools and day care centers (it is not regulated, and link to national website that provides more information)

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- Reference to a national website that provides a video version of basic educational information, including information on how the LCR works (with minority language versions)
- Where to get more information on drinking water, on lead in water, and on lead in general

3.2.2 Revise the current CCR language

The CCR is a necessary but not sufficient source of information for the public. It can provide general information, but is not designed to be frequent or detailed enough for all public education purposes. ~~Thus, the CCR should provide basic information and a link to the national clearinghouse described above for additional information.~~

~~The LCRWG agrees with the current requirement that~~ All community water systems (CWSs) should continue to include a statement about lead in their CCR. There may be circumstances (e.g. a subdivision built entirely after January 2014 when "lead-free" requirements came into effect), where a CWS can demonstrate that there are no lead-bearing materials in contact with drinking water. EPA may want to consider allowing the primacy agency to waive this CCR language requirement if an entire CWS can meet this this criterion. ~~an option that would allow the primacy agency to waive this requirement when a system can demonstrate that there are no lead bearing materials in contact with drinking water (e.g. a subdivision built entirely after January 2014). However, this determination should not be based solely on monitoring results.~~

~~The LCRWG further, the work group~~ recommends that ~~then revised~~ CCR language should be strengthened to include:

- Public health statements updated to reflect current understandings that there is no safe level of lead and a summary of the health effects, that this risk pertains to everyone, and that some individuals are particularly vulnerable;
- A link to the national clearinghouse ~~should be added to the CCR for all CWSs web-site~~;
- Recognition that a CWS's compliance with federal regulations does not guarantee what level of lead (lower or higher) might be found at the tap in a particular home; and
- The message that customers play an important role in protecting themselves from exposure to lead.

In addition, the work group recommends that PWSs where full or partial lead service lines exist (or are presumed to exist until an inventory demonstrates otherwise) also add information about what a lead service line is and how to contact the utility for information about how to find out if you have one and why you should replace it.

Further, ~~T~~he LCRWG recommends that the following redraft of the CCR be considered as a starting point for incorporating the elements listed above, to be reviewed by a diverse group of experts involving people with diverse, and consumer-oriented expertise and perspectives, including consumer-centered risk communication experts, community members with extensive experience with lead in water including individuals not necessarily affiliated with an organization, lead/copper corrosion experts, grassroots public-health workers, and staff of PWSs, state and federal regulatory agencies and public health agencies.

~~The following is a suggested revision intended to increase public awareness about LSLs and to encourage public engagement in replacing them (added language is underlined).~~

Important Information from EPA about Lead *If lead is present in your drinking water, ~~it elevated levels of lead~~ can cause serious health problems, especially for pregnant women and*

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young children. Lead can affect children's brains and developing nervous systems, causing reduced IQ, learning disabilities and behavioral problems. Lead is also harmful to adults. Lead in drinking water is primarily from materials and components associated with ~~service lines and~~ home plumbing and service lines (the pipe connecting your home to the water main). ~~(System name) is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components.~~ Contact us for information about lead service lines, how to find out if you have one and why you should replace it. [Last sentence for systems with LSLs.]

~~When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking.~~ Protecting you against exposure to lead is a shared responsibility. Your water utility is required to minimize the corrosivity of the water. However, because every home is different, the amount of lead in your tap water may be lower or higher than the monitoring results for your public water system as a whole. ~~Protecting you against exposure to lead is a shared responsibility.~~ You can take responsibility for identifying and removing lead materials within your home plumbing and taking steps to reduce your family's risk ~~such as running the water until it is fresh or using a filter.~~ If you have lead service lines or lead-bearing materials in your home, ~~are concerned about lead in your water,~~ you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at 1-800-426-4791 or [HYPERLINK "http://www.epa.gov/safewater/lead"]. *[Insert new national web site link]*

~~*Alternative proposal:*~~

~~*Important Information from EPA about Lead If lead is present, elevated levels of in your drinking water, it can cause miscarriage, fetal death, and serious health problems, especially for fetuses, infants (dependent on reconstituted formula), pregnant women and young children. Lead in drinking water comes primarily from materials and components associated with service lines and home plumbing and service lines (the pipe connecting your home/house to the water main) and can appear sporadically, at different times of the day and year. (System name) is responsible for providing high quality drinking water, but cannot control the variety of materials used in plumbing components.*~~

~~*When your water has been sitting for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using water for drinking or cooking. Your water utility is required to minimize the corrosivity of the water (i.e., the water's ability to eat away at plumbing materials and carry lead to your tap). However, because every home is different, the amount of lead in your tap water may be lower or higher than the monitoring results for your public water system as a whole. Protecting you against exposure to lead is a shared responsibility between your water utility and you.*~~

~~*If your home was built before 2014, it is likely to have lead-bearing plumbing components (e.g., lead service line, lead solder, leaded brass). Lead service lines are the most significant source of lead in drinking water. Some homes in our community have lead lines connecting the home to the water main. If your home has a LSL, pregnant women, infants and children should not drink the water or use it for cooking unfiltered lead release from lead service lines is very difficult to control. The treatment provided by [PWS] can lower the lead levels, but cannot eliminate all risk. Contact us for information about how to find out if you have a lead service line and why you should replace it.*~~

As long as your home has lead-bearing plumbing, you are at risk of exposure to lead. You can identify and remove lead materials within your home plumbing and take steps to reduce your family's risk, such as running the water until it is fresh or using a filter. If you have lead service lines or lead-bearing materials in your home, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline at 1-800-426-4791 or [HYPERLINK "http://www.epa.gov/safewater/lead"]. *[insert new national web site link]*

3.2.3 Strengthen requirements for public access to information

Commented [GB15]: Yanna and Steve are working on a recommendation regarding outreach to vulnerable populations. (make compliance section consistent with what the WG decides)

The LCWWG supports the public's right to know about the quality of their water and considered various options to increase the public's access to data related to lead and copper.

Under the current rule, the PWS is only required to make publicly available through the Consumer Confidence Reports (CCR) that "90th percentile value of the most recent round of sampling and the number of sampling site exceeding the action level." 40 CFR 141.153. In many jurisdictions, a concerned citizen may be able to obtain or view a redacted version of the complete sampling data set but this approach is time-consuming and burdensome on the PWS (or the state) and the community. EPA receives only a summary of the sampling results.

As the LCRWG evaluated different approaches, we kept in mind EPA's Office of Enforcement and Compliance Assurance (OECA) five principles for highly effective regulations and that OECA is working with regulatory programs to evaluate new and revised rules against these principles. Principle 4 calls for rules to "leverage accountability and transparency by providing the government and the public with real-time access to quality information on regulated entities' emissions, discharges and key compliance activities and outcomes." OECA identified two tools to accomplish this:

- Electronic reporting to the government.
- Public accountability via websites, paper/electronic mailings, and other ways to provide the public and stakeholders (e.g., customers, ratepayers) with compliance information.

The LCRWG encourages EPA to use the SDWIS-Prime data system that is under development to meet the first provision of the above goal. Electronic reporting from utilities to a centralized data system would allow the public to access data from the State or EPA in a coordinated manner and allow for consistent access to all water quality data, not just data for lead and copper.

Commented [GB16]: Define in a footnote?

Until such time as the new data system is in place, though, the LCRWG believes that water systems should increase the availability of data to the public. This would include:

- The number of samples over the Household Action Level in the last monitoring period, the highest level found during the last monitoring period, and the median levels as well as the current "system action level" (renamed from the current action level).
- Requiring water systems to include WQP-related information on their webpage, or in the CCR or some equally accessible manner (e.g., CCT treatment, approved WQP ranges, WQP results from the last monitoring period.)
- Encouraging water systems to post additional information on their webpages such as:
  - Public education materials (and link to National Clearinghouse)
  - Sampling protocol the water system provides to customers to use when collecting lead sample and any variations from EPA recommendations.
  - Individual sampling results (with appropriate privacy provisions such as address redaction)
  - Inventory (such as a map) of confirmed and presumed lead service lines

Commented [GB17]: Review based on final monitoring recommendations (whether there will be a recommended system action level requirement and, if so, what?)

Commented [GB18]: Review based on final monitoring recommendations

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Where a community has lead service lines, EPA should require PWSs provide a public statement of lead service line ownership and the legal basis of said determination. (See section 3.1.2, point 5 *"Control and Responsibility."*)

~~Greater public access to information about lead in drinking water is needed. The methods for ensuring access may vary based on individual system circumstances and size. The LCRWG recommends the following requirements be included in a revised LCR:~~

- ~~Utilities serving populations greater than 100,000 currently are required to post their CCR on a publically accessible web site and many have their own web site. The LCR should be revised to require that systems with their own web sites provide information on their web site about lead service lines, how to determine if they have one, associated risk, information about in-home sampling (as further described in Section 4.5), risk reduction options, and full lead service line replacement options.~~

- ~~Systems with the lead service line replacement program described in section 4.1 above should implement a program of targeted outreach to customers with LSLs, which would inform the customer that they have a LSL and/or how to determine if they have one, the health risks associated with exposure to lead, risk reduction options and their options for full LSL replacement. Targeted outreach would be based on available information, updated over time, per recommendation 4.1.1 above. When detailed understanding of LSL occurrence is lacking, then targeting can be based on more general information such as development period of home, or even distributed to communities as a whole.~~

- ~~The LCR also should require that information about the risks of lead from lead-bearing plumbing generally be provided in the utility's "new account" welcome letter to all customers, and EPA should include other options for effective communication of this information in guidance.~~

~~*The following was not discussed on the small group call; it is included for discussion at the April meeting.*~~

~~Option 3:~~

~~Robust PIs about the risks of lead-bearing plumbing and the benefits of a) removing this plumbing, and/or b) taking regular precautions when cooking or drinking, would be delivered regularly, regardless of a PWS's compliance with the LAL and regardless of whether there are LSLs in the service area since lead leaching can occur in buildings without LSLs.~~

3.2.4 Public Education Compliance

3.2.4.a PE Compliance for CCR

Recordkeeping, reporting and violations: Same as in the current CCR rule, with updated content.

3.2.4.b PE Compliance for Public Access to Information

PWS must provide the public access to information about:

- Number of samples over the Household Action Level, median and highest level found in the last monitoring period
- CCT treatment, approved WQP ranges and WQP results from the last monitoring period

Commented [GB19]: NOTE: These ideas have been included in a new paragraph just before 3.2.1, asking EPA to look into methods for communicating this information as well as to draw attention to the information in the clearinghouse generally.

Commented [GB20]: Is this worded correctly?

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Violations:

- Failure to make this information available to the public

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3.3 Improve Corrosion Control

~~PWSs subject to the LCR are required to minimize lead and copper levels at consumers' taps by controlling corrosion in the distribution system.~~ Corrosion Control Treatment (CCT) involves the addition of chemicals (e.g. orthophosphates or silicate) to create a barrier between the pipes and the drinking water, or to modify drinking water chemistry (such as pH and hardness) to inhibit the potential for corrosion. The concept is to manage the treatment system to reduce corrosion (and, thus, the release of metals such as lead and copper) from the distribution system and premise plumbing.

Under the current LCR, PWSs serving more than 50,000 people were required to work with their primacy agency (typically the state) from 1994 to 1997 to designate and install optimal corrosion control treatment. Systems serving 50,000 people or less must optimize corrosion control treatment only if the results of lead and copper tap sample exceed the action levels. A PWS exceeds the action level if ten percent or more of the tap samples collected are greater than the 15 ppb action level.

Based on the experience with current LCR requirements provided to this work group and shared by work group members, ~~T~~the LCRWG has concluded the following:

- ~~Lead occurs in different forms in plumbing systems, from soluble to insoluble and particulate in nature. PWSs vary in their sources of lead from the very common leaded solder and brass fixtures/valves, to LSLs, and to less common lead-lined iron pipe.~~
- CCT remains~~is~~ an important component of the LCR, in that it is intended to achieve a water quality that minimizes dissolution of lead in water. However, advances in knowledge about CCT, greater awareness of what is not sufficiently well understood, and the implementation of LSL replacement programs by all systems regardless of tap monitoring results and adjustments to CCT if the recommendations in this report are implemented all need to be considered going forward.
- Effective CCT is complicated. A variety of factors affect the dissolution of lead in water, including but not limited to pH and alkalinity. Factors other than the stability of designated WQPs can include, among others, the formation/dissolution of protective scales; the presence of manganese, iron, chlorides, sulfates, aluminum and other materials; and temperature. Variations in water quality also can occur within the distribution system. These water quality conditions vary among PWSs, which in turn affect the CCT choices a PWS must make in in the context of other regulatory requirements. Thus, the discussions between the PWS and the primacy agency about the treatment plan and its associated water quality parameters should apply the most current science, tailored to the unique circumstances of each system. Experience with the LCR also suggests that it may be possible to improve CCT by setting tighter ranges to WQPs in some circumstances and by paying more attention to process controls with more frequent monitoring of WQPs.

Commented [GB21]: Is this last statement true?

- Lead occurs in different forms in plumbing systems, from soluble to insoluble and particulate in nature. PWSs vary in their sources of lead from the very common leaded solder and brass fixtures/valves, to LSLs, and to less common lead-lined iron pipe. CCT is more effective in reducing exposure to soluble lead than it is for particulate lead, which is one of the reasons the LCRWG has recommended that all systems with LSLs be required to replace them rather linking replacement programs to a lead AL exceedance and implementation of CCT.
- In sum, CCT is not the only lead control mechanism that a PWS must have in place. In other words, CCT should not be relied upon by itself to control lead in water. Rather, it should be one of a tool box of other required mechanisms depending on a PWS's particular conditions and lead

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sources (e.g. LSLs, lead solder, leaded brass, etc.). These tools are described in other sections of this report and include: LSL replacement (as well as the replacement of other less common sources of lead such as lead-lined iron pipe), current and future use of lead-free materials, stronger public education including targeted public education to vulnerable populations, availability of certified POU filters, instructions on how to flush plumbing systems when lead could be disturbed, etc.

Commented [GB22]: A member suggested defining vulnerable populations

~~Water quality conditions vary among PWSs, which in turn affect the CCT choices a PWS must make in the context of other regulatory requirements.~~

- ~~Experience to date suggests that it is possible to improve CCT, for example by setting tighter ranges to WQPs in some situations. However, given the considerations noted above, determining the most effective CCT approach is a very complex task.~~

3.3.1 Corrosion Control Recommendations

Thus, the LCRWG recommends that:

Commented [GB23]: NOTE: This is based on the proposal discussed at the April meeting. Yanna L discussed another proposal with the compliance small group, which will be put on the June agenda. The comment field below was added to prompt discussion of her proposal.

- EPA release a revised CCT guidance manual as soon as possible and update this manual every six~~three to five years~~, so that PWSs and primacy agencies can take advantage of improvements in the science;
- EPA provide increased expert assistance on CCT to PWSs and primacy agencies;

Commented [GB24]:

- The LCR continue to require reevaluation of CCT when a PWS makes a change in treatment or source water;

Commented [GB25]: Should the revised LCR also require re-evaluation of CCT based on monitoring data?

- The LCR continue to require WQP monitoring to ensure that the CCT is achieving the treatment objectives and that EPA consider requiring such monitoring on a more frequent basis with additional guidance on process control methods; and
- The LCRWG recommends that the LCR be revised to require that large systems review their existing CCT plan in light of current science in a newly revised guidance manual with their primacy agency to determine whether the WQPs reflect the best available current science. The LCRWG suggests that this review be done every six years following EPA's six year rule review cycle, and subject to there being sufficient science change that EPA updated the guidance manual. EPA should plan to review and refresh Agency guidance every 6 years, subject to significant improvement in the state of knowledge, to allow research to inform rule implementation. In addition, regularly revised guidance would help states and systems stay current with corrosion control science as they respond to problem situations, but more importantly help them anticipate challenges as new water sources and treatments are brought on line, or they contemplate further refinement to corrosion control. ~~The LCR be revised to require existing CCT plans be reviewed by the primacy agency on a *insert frequency* basis, include in that reassessment the range of factors that can affect the dissolution of lead in water, and consider whether the WQP ranges can be tightened.~~

Commented [GB26]: Is there a way to tier this for medium and small systems, either linked to spikes in tap sampling results, different time tables, other? Could the concept be similar to what small and medium systems already do for wastewater discharge monitoring reports?

3.3.2 Corrosion Control Compliance

Commented [GB27]: This reflects the recommendations discussed at the April meeting. Update based on modified or additional recommendations

PWS must maintain records that it reviewed new EPA guidance manuals and assessed the need to make changes to CCT.

Violations:

- Failure to notify and consult with primacy agency on re-evaluating CCT if the PWS makes a change in treatment or source water

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- Failure to review CCT when EPA updates the guidance manual (for large systems)
- Failure to act if state notifies them that they should assess CCT or make adjustments, based on state review of guidance manual (for medium and small systems)
- .....

3.4 Modify Monitoring Requirements

Commented [GB28]: See comments above about alternate proposal.

Under the current LCR, a PWS is required to conduct monitoring to assess the effectiveness of its corrosion control treatment (CCT) 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. In the Lead and Copper Rule (LCR), water systems must prioritize sample site locations (often residences) within the distribution system which are at a high-risk of elevated lead and/or copper in the water. Selection and use of these elevated lead and copper sites enables a smaller number of sample sites than random or geographic site selection procedures.

Implementation of this approach over time has revealed numerous challenges. Recruitment of customers to take in-home samples is difficult. Customers are not professional samplers and, thus, may implement the sampling protocols inconsistently. Research on sampling protocols has shown that sampling results may vary, and not necessarily consistently, based on the configuration and length of lines from the water main to the sampling tap and whether the sample is a first draw or a subsequent sample intended to reflect water that had been in a LSL for some time.

In addition, while such sampling is intended to assess the effectiveness of CCT to achieve public health protection rather than as a direct measure of public health protection itself, concerns about residents of individual households still being exposed to high levels of lead are understandable, whether or not the system as a whole exceeds the AL. Concerns that adjustments to CCT can't reduce public health risk when high lead levels in individual samples may come from particulate lead also must be taken seriously, particularly given the risk of changes to CCT causing unintended consequences to other aspects of drinking water treatment.

The LCRWG ~~agreed that there is a role for both WQP monitoring and lead sampling in homes.~~ recommends two types of ongoing monitoring: 1) a more robust water quality parameter monitoring program, and 2) voluntary customer initiated tap water sampling coupled with a more robust and targeted public education program to encourage sampling.

3.4.1 Water Quality Parameter Monitoring

In this section, WQP monitoring is distinguished from the more extensive list of parameters that a water system would consider as it evaluates corrosion control technology choices. WQPs for the purpose of this section involve the on-going process control monitoring that demonstrates that the selected treatment is being properly operated over time.

Commented [GB29]: Does the LCRWG wish to recommend a broader range of WQPs for process control purposes?

The WQP program recommended below builds on what is in the current rule by recommending (as referenced in Section 4.3 above):

1) more frequent monitoring than present and monitoring that is better distributed through out the distribution system (e.g. at points currently used for TCR monitoring) to capture currently undetected variability;

2) that it be periodically revisited based on the advancing science as documented in research reports and disseminated through periodically revised EPA guidance manuals; and

3) that a more rigorous data review process such as control charting and similar process control techniques be used to take advantage of the collected data to improve the consistency of operation, encourage fine-tuning of processes, reduce variability of water quality within the distribution system and detect and manage excursions.

In addition, this data should be reviewed whenever there is a change in source or treatment (see 4.3 above); and, when a system or state primacy agency sees significant changes in WQP data, it should initiate a "find and fix" process, looking for what changed and why, and requiring the PWS make any needed adjustments or corrections. This provides one type of reality check and correction not explicitly in the current LCR.

In addition, the LCRWG recommends that systems which are not currently practicing CCT under the LCR but have been under the lead action level by virtue of either naturally non-aggressive source water or by virtue of other aspects of treatment in use, be required to conduct a WQP monitoring program to continue to demonstrate that the characteristics which caused them to be non-corrosive are continuing to be in place.

3.4.2 Customer Sampling

The LCRWG also recommends that a voluntary customer-initiated sampling program based on the more robust and targeted public education efforts being recommended elsewhere in this report be substituted for the current LCR tap sampling requirements. Revisions to the LCR should require that outreach to the general public, households with lead services, and vulnerable populations such as pregnant women and households with young children offer free lead sampling.

The results of the voluntary tap sampling program will be used for three separate purposes:

- informing and empowering individual households to take action to reduce risk,
- reporting to health officials when monitoring results exceed a "household action level" (see section ....) and
- ongoing information to the utility to assess effectiveness of CCT.

Information for Households

Data from customer-initiated sampling will be valuable in informing and empowering individual households and thus provide greater customer service. All data provided to customers would need to include appropriate information about the variability of lead levels, that a single sample does not represent all water quality, and that levels at a particular tap at a particular time might be higher or lower. The transmittal should also provide appropriate information about the risks of lead exposure, sensitive populations, and actions the consumer can take to minimize risk.

This type of sampling is currently discouraged by the current rule because water systems are often concerned that "complaint" or "customer " samples would be included into the required 90th percentile calculation with potential mandatory response actions if it exceeded the action level. This resulted in system not offering sampling or having the samples be analyzed through a private lab (and therefore the data would not be available for any utility management or regulatory purpose). Currently, PWSs are mandated to return to the same locations which, while it may have value for other reasons, means that many other households do not get the opportunity to understand their lead exposure. Voluntary customer-initiated sampling can also capture data from multi-family residences, which is not included in the mandatory LCR sampling in most cases. A new approach could achieve greater customer service and more data to understand and manage lead corrosion.

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Information for Public Health Officials

Data from customer samples which exceeded the "household action level" recommended in section X.x, would be required to be forwarded to health officials. While LCR tap water results are currently provided to the collecting household, the LCR does not require any action for individual high samples, and there is no mandate to refer to health authorities. This recommendation provides direct health intervention in those cases where sampling indicates high lead levels.

Information for Assessing the Effectiveness of CCT

The third use of the customer tap sampling data is to provide on-going information to the utility of potential changes in the effectiveness of CCT. Under the current rule, most systems are sampling for one four-month period every three years. Any changes or variability in lead levels at the tap during the other 32 months of that period are missed. Under this proposal, it is anticipated that there would be a more regular stream of data from more locations, providing information which can be used to understand system performance. The data would be provided to the state primacy agency and presented as time series data to facilitate identifying any changes in the data over time. Small systems might report the data on something as simple as a spreadsheet chart, while larger systems might use more sophisticated analytical methods to understand and use the data.

Unexpected or unexplained changes in the tap sampling data can be used in a "find and fix" approach to identify and respond to potential problems. This could be system initiated or in response to periodic review of the system data by the primacy agency, such as during a sanitary survey. This provides a reality check on whether something unexpected is happening within the distribution system, even though consistent treatment was maintained. The more robust (in both temporal and geographic distribution) of the customer sample data set provides a more powerful check on treatment than the current episodic sampling does.

It seems appropriate to include some sort of floor to the number of customer samples. Some members of the group suggested that systems should be required to collect no fewer samples in a three year period than they would under the current three-year reduced monitoring requirement.

Commented [GB30]: Should there be language describing the types of locations for samples that would be counted as part of the "floor?"

When a system changes its source or treatment, and is required to consult with the state, the state primacy agency also may choose to require additional one-time monitoring to evaluate those changes if the degree of the change warrants.

Some members suggested that some small systems might want the opportunity to maintain the current home tap water monitoring program. The revised LCR should allow this, while not discouraging customer sampling.

[NOTE: Remaining monitoring text from previous draft was deleted (very long and outdated).]

3.4.3 Sample Invalidation Criteria

Under the existing regulation (141.86 (f)(1)), "The State may invalidate a lead or copper tap water sample if at least one of the following conditions is met.

(i) The laboratory establishes that improper sample analysis caused erroneous results.
(ii) The State determines that the sample was taken from a site that did not meet the site selection criteria of this section.
(iii) The sample container was damaged in transit.

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(iv) There is substantial reason to believe that the sample was subject to tampering."

These are all good and necessary reasons for invalidating a sample and should be retained, but because this list is limited, samples must be accepted that are obvious "outliers" and don't represent the water that is normally consumed and should not be used as a basis for treatment changes or public education. This is especially true for small systems where the limited number of samples required means that a single, unusually high, value can cause the Action Level to be exceeded. This could lead to installation of expensive treatment when treatment is not needed or adequate corrosion control is already being provided. While probably not as frequent, non-representative samples could also cause water systems to be below the action level when treatment changes really are needed. Good invalidation criteria can help states address both problems.

The purpose of the invalidation is to make sure that decisions are based on the most representative set of samples possible and to do so through a process that provides adequate information to make good invalidation decisions and assures documentation of the reasoning behind the invalidation.

The following is a proposal from states that will serve those two functions.

States believe that the essential criteria for invalidation are already well stated in the [HYPERLINK "http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/upload/Revised-Lead-and-Copper-Rule-Monitoring-and-Reporting-Guidance-for-Public-Water-Systems.pdf"] or the October 2006 memorandum on [HYPERLINK "http://water.epa.gov/lawsregs/guidance/sdwa/upload/wsg_178.pdf"]. The language in these documents is consistent with the sampling requirements in 141.86 (b).

- "Always collect a first-draw sample from a tap where the water has stood in the pipes for at least six hours (e.g., no flushing, showering, etc.). However, make sure it is a tap that is used regularly, and not an abandoned or infrequently used tap."
- "First-draw samples collected at single-family residences must always be drawn from the cold-water kitchen tap or bathroom tap."
- "First-draw samples collected from buildings other than single-family homes must always be drawn from an interior tap from which water is typically taken for consumption."
- "Therefore, public water systems should not recommend that customers remove or clean aerators prior to or during the collection of tap samples for lead."

3.4.4. Monitoring Compliance

CWS must monitor and report based on water quality parameters and schedule set by state primacy agency, and use the data for on-going treatment process control (3.4.1)

Violations:

- Failure to monitor as per schedule
- Failure to maintain data, and use in process monitoring (to be evaluated by state during sanitary survey inspections or as state primacy agency requests)
- Failure to report data to state
- *[something similar to the current rule requirement if data indicates that treatment is outside WQP limits]*

CWS also must include an offer to customers in all LCR related outreach to conduct a sample, including in all LSL outreach efforts. CWS must also:

- collect sufficient number of samples, either by customer request or utility initiated sampling;

Commented [GB31]: A member commented that this may need to be revisited based on the purpose and role of lead/copper sampling.

Commented [GB32]: This reflects the recommendations discussed at the April meeting. Update based on modified or additional recommendations

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- promptly report the data to the customer, the state and local PH (if above health action level); and
- use the data as part of on-going evaluation of CCT performance, monitoring for changes in lead levels at the tap over time, geographic trends in levels, and interaction with distribution system water quality.

Violations:

- Failure to offer to sample
- Failure to collect minimum number of required samples *[at specified locations?]* within 3-year window
- Failure to report data to:
  - Household
  - State
  - Local public health agency (if above household action level)
- Failure to provide rule-required information in sampling offer materials, or in household reporting of the data
- Failure to use household tap sampling data in on-going evaluation of CCT and maintain record of having done so, (as determined by state during sanitary survey inspections or as state primacy agency requests)

3.5 Establish a Household Action LevelHealth-Based, Substantial and Imminent Endangerment Standard

The current lead action level is based on the 90th percentile of the collected samples. Without a maximum limit, some users may be exposed to levels of lead in the drinking water that presents a potentially significant health threat, especially to children, without exceeding the action level. If the levels are high enough and state and local authorities do not act, EPA could determine that the levels pose "an imminent and substantial endangerment to the health of persons" pursuant to section 1431 of the Safe Drinking Water Act (40 USC 300i)

3.5.1 Household Action Level Recommendations

To avoid the need to invoke section 1431 of the SDWA, the LCRWG recommends that EPA establish in a revised rule a "household action level" and require the PWS to notify the local health department and state drinking water authority of sample results over that level. The requirement would be triggered by any sample results that the PWS receives from a user or from its own monitoring. However, the PWS would not be required to make the notification until it has investigated the sample in a timely manner to eliminate sampling or assay errors. The existing action level would be renamed as a "system action level."

The existing rule already requires the PWS to notify residents of the results of water system conducted lead sampling. We would anticipate that the PWS would alert the resident to possibility that the health department may be notified when the sample was taken or the resident provided the PWS with the sample results. While this notice may have the unintended consequence of discouraging some customers from testing, it is important for the customer to make an informed choice.

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Commented [GB35]: This reference to a 3-year window is intended to reflect the text above regarding maintaining a floor to the number of tap samples…. "systems should be required to collect no fewer samples in a three year period than they would under the current three-year reduced monitoring requirement"

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Commented [GB36]: Review rest of document for this term to check for consistency (with what the role of a system action levels ends up being and for terminology)

In response to the notification, the PWS and the health department would consider the situation and take action that they deem appropriate (e.g., testing children's blood, recommending a filter, discussing lead service line replacement with the resident or landlord, advising grandparents about risk to visiting children, or continuing to monitor the situation). We anticipate that the health department be the lead agency, and that the rule would not prescribe actions other than notice as the situations are too diverse and complicated for prescription actions. The LCRWG encourages EPA to work with the Centers for Disease Control and Prevention on recommended approaches and make this information available through the clearinghouse discussed in section 4.2.

This requirement would be somewhat similar to the regulatory approach taken by the Department of Housing and Urban Development which mandates that public housing authorities notify the local health department within five days when it receives information from any source that a child of less than six years of age living in an assisted dwelling unit may have an environmental intervention blood lead level. (24 CFR 35.1225)

We recommend that EPA set the household action level based on the amount it would take for an infant to have a blood lead level greater than five micrograms per deciliter (ug/dL) based on consumption of infant formula made with water. When a child's blood lead level exceeds five ug/dL, the Centers for Disease Control and Prevention (CDC) recommends that laboratories and health care providers notify local and state health departments and that action be taken to identify and prevent further exposure.[12] While unlikely, if the calculation shows that the household action level is lower than the system action level, EPA would need to reassess the approach.

3.5.2 Household Action Level Compliance

If household sample exceeds the household action level, PWS must promptly notify the household and the local public health agency, certify that this has been done, and maintain records of having done so.

Violations:

- Failure to timely report data to:
  - Household
  - Local public health agency
- Failure to certify to state that this has been done
- Failure to maintain records of correspondence between CWS and PH

~~The current LCR attaches PWS compliance to two main requirements: staying within a set range of water quality parameters and staying under the LAL. However, neither requirement directly corresponds to consumer exposure to lead in water or associated health risks from such exposure. In other words, neither requirement is designed to directly protect public health. Specifically, staying within a set range of water quality parameters does not address all the factors that cause lead to leach into the water, and staying below the LAL does not address the health hazard of exposure to lead for many homes (whether lead levels tend to be <15 ppb but above the MCLG of zero, or whether they tend to be >15 ppb). This leaves large segments of the public unprotected from exposure to lead in water but assured that their water is safe to drink.~~

[12] http://www.cdc.gov/nceh/lead/ACCLPP/blood_lead_levels.htm

Commented [GB37]: A member commented that the LCR should include a requirement for remedial action at the home.

Commented [GB38]: A member suggested that the information from the PWS include information the health dept can use in its outreach to residents.

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~~This, in addition to the public education and LSL removal programs described in earlier sections of this report, the LCR should be revised to establish a health based standard that identifies a "substantial and imminent endangerment" threat from lead in water. This concept can be found under other environmental programs (e.g. CERCLA) where exposure risks are considered so high that immediate action must be taken. For example, this would be analogous to a situation in which EPA's Superfund program would require bottled water to be provided to individuals with drinking water from wells where ground water samples of lead reached this level of concern. In a SDWA context, this could be a threshold set such that an infant on formula would be expected to have blood lead levels above the current threshold of concern of 5 micrograms per deciliter set by the Centers for Disease Control and Prevention (CDC). (A handout distributed at a meeting referred to an EPA web site that identified 40 ppb for school-aged children.)~~

~~The LCRWG recommends EPA calculate such a level of concern and, where in-home tap samples exceed the level of concern regardless of whether there is an AL exceedance, require PWSs to communicate directly with the customer, recommend blood lead testing for residents, provide water filters rated effective for the lead levels found in the samples taken, and provide the customer an opportunity to participate in a full LSL replacement program. In addition, the PWS should be required to notify other similarly situated customers in the service area.~~

~~1.~~3.6 Establish Separate Monitoring Requirements for Copper

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The current LCR does not deal effectively with copper. Generally speaking, the current rule focuses on the health benefits associated with lead risk reduction, with the result that the currently required in-home sampling is often done in locations with old copper that has passivated. Thus, the possibility may be missed that a system's water chemistry could result in copper releases. Further, the current rule does not require public education for copper, which can have broad benefits.

The LCRWG has concluded that the regulatory approach should separate lead and copper risk management, refocusing attention to where there may be a problem with copper without increasing the burden on systems where there is not a problem. This can be achieved in a cost effective manner by targeting copper monitoring requirements to those PWSs where there may be exposures.

Elevated exposures to copper generally result from new copper plumbing[13] where water chemistry is aggressive to copper. It is technically possible to identify water chemistries that are aggressive versus not aggressive to copper. Thus, the LCRWG recommends that the requirements for copper monitoring focus first on sampling for basic finished water quality parameters such as pH and alkalinity in a way that is representative of the distribution system to identify waters that are aggressive to copper. Systems that can demonstrate that their finished waters are not aggressive to copper or that their distribution systems contain no copper should have no further copper monitoring requirements. This could be written into the rule, rather than require a monitoring "waiver." ~~Systems with water quality parameters that are aggressive to copper should implement appropriate corrosion control treatment and water quality parameters for copper. This could be written into the rule, rather than require a monitoring "waiver."~~

3.6.1 Copper Recommendations

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Further~~Thus~~, the LCRWG recommends that the LCR be revised based on the following concepts:

[13] New copper is generally understood to be up to six months to three years of age.

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1. Instead of basing action on the results of routine, in-home copper sampling, actions should be based on the aggressiveness of the water to copper. Systems can determine if their water is aggressive to copper by doing WQP monitoring in the distribution system. All PWSs should be assumed to have water that is aggressive to copper unless they demonstrate that it isn't.

2. EPA should develop criteria to define water that is not aggressive to copper for the purpose of establishing whether a system falls into that category (or "bin") for the purposes of the LCR. EPA should consider the accuracy and potential variability of pH and alkalinity monitoring as well as corrosivity to copper in establishing pH and alkalinity ranges. The criteria also should include consideration of passivation time. Examples of bins would be:

    a. if alkalinity is < 35 pH must be > 7.0 (no upper pH limit)
    b. if alkalinity is 36 to 100, pH must be > 7.2
    c. if alkalinity is 101 to 150 , pH must be > 7.5
    d. if alkalinity is 151-250 , pH must be > 8

3. PWSs can choose one of several approaches to demonstrate that their water is not aggressive to copper:

    a. Conduct water quality parameter monitoring to assess whether their water meets the definition established by EPA.

    b. Conduct copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL). EPA may want to consider:

        i. Limited number of sample sites needed given copper chemistry

        ii. Provision for sample invalidation based on site-specific conditions such as biologically-induced corrosion.

    c. Conduct a pipe loop study to demonstrate the water chemistry is non-aggressive

    d. Change water chemistry to within the range established for non-aggressive water quality

4. PWSs with water **classified as non-aggressive to copper** must continue to demonstrate that the water is non-aggressive. PWS's can choose to:

    a. Maintain those WQPs that demonstrate it maintains non-aggressive water under (2) above.

    b. Conduct copper sampling at vulnerable houses (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive (copper levels fall under the AL/SMCL)

    PWSs that are not able to maintain their WQPs must implement a public education program as described in the next section.

5. PWS's with water **classified as aggressive to copper** must initiate and maintain a public education program. The public education program must either provide:

    a. ~~Targeted i~~Information to all new homes (new construction or change of service) upon initiation of new service ~~or newly renovated homes~~

    AND~~OR~~

    b.

i. Information to newly renovated homes at time of renovation

OR

~~i.~~ii. Information~~is provided~~ to all customers on a routine basis~~annually (choice is systems)~~

In addition, in guidance, EPA should encourage PWSs to notify contractors, plumbing suppliers, and plumbers of copper corrosivity and to work with relevant officials and organizations to consider building codes changes that would prohibit ~~to not allow~~ copper piping in new construction if the corrosive water conditions cannot be eliminated. EPA also should provide guidance and/or templates, particularly for small systems, for public education messages and modes of delivery.

6. EPA should consider whether or not CCT should be required for a PWS classified as aggressive to copper. Not all systems with water aggressive to copper necessarily will have homes with new copper, so treatment might not be necessary or perhaps even advisable, particularly for small systems that can control plumbing materials used or for systems in communities that modify their plumbing codes. Passivation time of copper varies considerably, and CCT may not be necessary or advisable when passivation time is short if interim actions to protect public health other than CCT are feasible. In determining when CCT should be required and any associated monitoring requirements, EPA also should take into consideration that a PWS may not have access to information about renovations where new copper has been installed and, even when such information is available, can't control whether the customer will participate in a monitoring program. Setting the correct level and establishing a regulatory approach that triggers CCT only when necessary will require a complex assessment and is beyond the scope of this workgroup.

~~6.~~7. In the revised LCR, systems should continue to be required to notify the primacy agency if they are making any long-term treatment change or addition of a new source. This section of the rule should be made clear that for copper, the system may be required to demonstrate that its finished water continues to be non-aggressive to copper (per 4 above).

~~7. A violation would be:~~

~~a. Failure to implement PE, for PWSs that have not demonstrated their water chemistry is not aggressive to copper.~~

~~b. Failure to maintain a monitoring program representative of the distribution system that demonstrates the system has water chemistry not aggressive to copper.~~

~~c. Failure to provide notice to and, if required, consultation with the primacy agency, when a PWS makes a significant change in source or treatment (as in the current LCR).~~

8. Additional information needs to be gathered on the current distribution of pH, alkalinity, and phosphate residual among systems nationally to fully understand the implications of this approach.

3.6.2 Copper Compliance

Violations:

- Failure to implement public education, for PWSs that have not demonstrated their water chemistry is not aggressive to copper.
- Failure to maintain a monitoring program representative of the distribution system that demonstrates the system has water chemistry not aggressive to copper.
- Failure to provide notice to and, if required, consultation with the primacy agency, when a PWS makes a significant change in source or treatment (as in the current LCR).

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- Failure to implement CCT or other risk reduction actions prior to CCT as determined by the primacy agency.

~~1.4 Addendum: Complementary Actions Critical to the Success of the National Effort to Reduce Lead in Drinking Water Recommendations for Additional Action~~

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The LCRWG urges EPA not only to promulgate a revised LCR, but also to play a leadership role in educating, motivating, and supporting the work of other agencies, where EPA does not have the authority to act. The Long Term Revisions to the Lead and Copper Rule (LTR LCR) are very important. However, removing lead from drinking water systems and ~~for~~ reducing exposure to lead from drinking water in the meantime ~~also~~ will require renewed commitment, cooperation and effort by government at all levels and by the general public.

Specific recommendations for action in addition to the LTR LCR include:
[Note: These items are taken from a variety of sources, are in no particular order, and will be edited after the April/February discussion.]

- EPA working across all offices to take an integrated approach to action and education on lead from all sources (paint, air, site clean–up, etc.), with proper emphasis on lead in drinking water, especially in relation to the populations most vulnerable to this source (i.e., fetuses and infants dependent on reconstituted formula). For example, OGWDW should coordinate with EPA's lead-based paint program so lead hazards are communicated consistently.

- Work with other federal agencies including HUD in terms of lead programs, including but not limited to expanding federal funding from those programs to include lead service line replacement; HUD/DOT in terms of efficiency in possible coordination of lead service line replacement with road projects, construction projects; and CDC in terms of childhood lead poisoning prevention, screening, and protection programs

- Enhanced cooperation with state, county, local health departments to promote an integrated approach to childhood lead poisoning screening, prevention, and protection that emphasizes drinking water and its potential as a primary lead source, especially for fetuses and infants dependent on reconstituted formula

- EPA needs to work with agencies at all levels of government to support financial assistance programs for LSL removal. Building costs into a PWS's capital budget planning should also be a consideration.

- EPA should include diverse perspectives in its stakeholder engagement programs, including affected consumers (who should not be required to be members of formal organizations), lead poisoning prevention/clean water advocates, EJ advocates, lead/copper corrosion experts, and representatives from PWSs, States, and federal agencies with Healthy Homes and childhood lead poisoning prevention programs..

- Zoning, including possibility of prohibiting copper plumbing where water is aggressive to copper

- A federal tax deduction to support replacement of the customer portion of LSLs

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- State Actions to support customer lead service line replacement, e.g.
  - State legislation requiring inspection or replacement on sale of home
  - Disclosure requirements at sale of home
  - Requirements for LSL removal as part of school and day care licensing
  - Building code requirements for LSL removal upon substantial renovation (could be national action as well)
  - Priority in SRF funding (especially if increased funding is available)

- PWSs should educate (encourage partnerships with?) healthcare providers and health departments even when levels are below the AL.

- Additional technical review (additional study?) is needed on flushing.

2.5 Conclusion

The LCRWG appreciates the opportunity to provide these recommendations to the NDWAC, offers our thanks to the experts and members of the public who made presentations to the work group, and wishes particularly to acknowledge EPA for the extensive commitment of staff time and expertise to this process.

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ATTACHMENT A

NDWAC Lead and Copper Working Group

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Leon Bethune: Director, Director of Office of Environmental Health, Boston Public Health Commission
Gary Burlingame: Laboratory Director, Philadelphia Water Department
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Message

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Subject: Information on CCT
Attachments: NDWAC WG Day 2 _ Consolidated - Use This.pptx; JAWWA Feb 1983 Karalekas et al.pdf; 2009_08_11_lcrmr_pdfs_Comparison_of_Lead_Action_Levels.pdf; Analysis of Impacts of CCT on LC Levels.pdf; 56FedReg3_CCT.pdf

Hi All,
I wanted to provide the presentation slides on CCT from the first meeting. I realize it was quite some time ago, so I thought this may be useful as you prepare your comments on the draft third report. Also attached, a couple studies/analysis on WQP and tap sample lead levels from the google drive. For background, I attached the CCT section of the 1991 LCR preamble and below is a short summary of the CCT requirements in the current rule.

I hope you find this useful.
Lisa

Current Rule

Three strategies – pH/alkalinity passivation, calcium carbonate precipitation, and inhibitor addition (orthophosphate or silicate)

State designation of optimal water quality parameters in 141.82(f):

(1) minimum value or range of values for pH measured at each point to the distribution system
(2) A minimum pH value, measure in all tap samples. Such values shall be equal to or greater than 7.0, unless the State determines that meeting a pH level of 7.0 is not technologically feasible or is not necessary to optimize corrosion control
(3) If a corrosion inhibitor is used, a minimum concentration or a range of concentrations for the inhibitor, measured at each entry point to the distribution system and in all tap samples, that the State determines is necessary to form a passivating film on the interior walls of the pipes of the distribution system.
(4) If alkalinity is adjusted as part of optimal corrosion control treatment, a minimum concentration or a range of concentrations for alkalinity, measured at each entry point to the distribution system and in all tap samples;
(5) If calcium carbonate stabilization is used as part of corrosion control, a minimum concentration or a range of concentrations for calcium, measured in all tap samples.

The values for the applicable water quality control parameters listed above shall be those that the State determines to reflect optimal corrosion control treatment for the system. **The State may designate values for additional water quality control parameters determined by the State to reflect optimal corrosion control for the system.**

NOTE: The five optimal water quality parameters listed in 141.82(f) are treatment-specific parameters in that they are critical parameters for any system using that particular treatment strategy. The bolded language from 141.82(f) on additional parameters is intended to cover system-specific parameters that do not apply to all systems using that particular corrosion control strategy, but are critical parameters for that system when it is using the corrosion control strategy.

Compliance Determination – Optimal Corrosion Control

The compliance determination for optimal corrosion control is to stay within the State-specified optimal water quality parameters. That would be any of the treatment-specific parameters plus any system-specific parameters required by the State. Systems can exceed the action level and still be in compliance with the corrosion control treatment element of the lead and copper rule treatment technique if they meet their optimal water quality parameters.

WQP monitoring frequencies:

Entry point to distribution system – minimum of every two weeks

Taps in distribution system (typically coliform sites) – twice at each location every six-months

Number of sites varies by system size: 1 – 25 (standard) and 1 – 10 (reduced)

Lead and copper tap monitoring results can trigger public education and lead service line replacement.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

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generally available throughout the United States.

When considering affordability of NPDWRs, EPA assesses whether the technology is reasonably affordable by regional and large metropolitan water systems (EPA is using a system size of 50,000 to 75,000 persons as a size cutoff to define large or regionalized water systems). This standard was established when the SDWA was enacted in 1974 ([see H.R. Rep. No. 93-1185 at 18 [1974] and reaffirmed when the Act was amended in 1986 (see 132 Cong. Rec. S6287 [May 21, 1986] [statement of Sen. Durenberger]). EPA also gives additional consideration to the total national costs to comply with the regulation.

Each of the four treatment technologies (corrosion control, source water reduction, public education, and lead service line replacement) identified as a part of the treatment technique are evaluated below in terms of their technological and economic feasibility and their ability to effectively reduce contaminant levels.

E. Corrosion Control Treatment

1. Available Treatments

The proposal presented three general corrosion control treatments available to public water systems to minimize lead and copper corrosion by-products at the tap: pH adjustment, pH adjustment in conjunction with alkalinity adjustment, and addition of corrosion inhibitors. Commenters raised three general issues with these corrosion control treatments: (1) The effectiveness of the different corrosion control treatments to reduce lead and/or copper levels; (2) the potential adverse secondary effects from corrosion control treatment; and (3) the need for assistance in developing corrosion control strategies.

a. *Cost and Effectiveness of Corrosion Control Treatment.* Many commenters stated that pH and alkalinity adjustment and addition of inhibitors are effective for reducing lead and copper levels at the tap, the treatments are generally available, and the costs are reasonable. Other commenters asserted that EPA had presented limited or unconvincing evidence that the corrosion control treatments cited are effective for reducing tap water lead and copper levels to the proposed action levels (average of 0.010 mg/L for lead and 1.3 mg/L for copper in 95 percent of samples). Several commenters stated that corrosion control may be effective for reducing the corrosion of lead pipes, but there is little evidence that corrosion control is effective in reducing dissolution of lead from solder, fixtures, or faucets.

It is important to recognize that unlike control technologies to treat source water contamination, control of corrosion byproducts does not involve removal of contaminants directly. Rather, corrosion control involves a variety of practices to prevent the contaminants from entering drinking water. The Agency acknowledges that precisely quantifying the effectiveness of corrosion control treatment under different water quality and distribution system configurations is difficult. The complexities involved in determining the appropriate treatment require that treatment decisions take into account the unique properties of the water used by a particular system and the physical configuration and material composition of the distribution system through which the water flows to consumers. These problems are discussed in more detail in section (b) below. Nevertheless, the Agency believes the data presented below demonstrate that proper application of pH adjustment in conjunction with alkalinity adjustment, calcium hardness adjustment, and the addition of corrosion inhibitors is effective for reducing lead and copper levels at the tap and that the cost (see Section X) to large metropolitan water systems to install and maintain the technologies is reasonable.

The Agency disagrees that there is little evidence that corrosion control is effective in reducing the dissolution of lead from lead solder. Data collected in the field and laboratory (Lyon and Lenihan, 1977; Oliphant, 1983; EPA, 1988e; AWWA-RF, 1990) and laboratory (Schock and Wagner, 1985; AWWA-RF, 1990) indicate that increasing Ph can substantially reduce lead dissolution from lead solder. Brass faucets and fixtures have recently been identified as a potentially significant source of lead in drinking water (Schock and Wagner, 1985; Schock and Neff, 1988; Gardels and Sorg, 1989; AWWSC, 1989), and consequently, little research has been conducted on effective treatment methods for minimizing the rate of dissolution from these faucets. Data from a limited number of locations indicate that while new brass faucets can contribute substantial amounts of lead to first-draw water for the first few weeks or months after installation, the rate of lead dissolution will rapidly decline to a low level and ultimately stabilize (PMI, 1990). Until additional data can be collected that provide a clearer indication of the rate of dissolution from brass faucets under a variety of water conditions, the extent to which faucets contribute to total tap water lead levels will remain difficult to quantify. EPA has sought to ensure that lead problems due to faucets are detected and addressed by requiring systems to minimize lead levels in first-flush water. In addition, EPA will shortly publish an Advanced Notice of Proposed Rulemaking for a TSCA Section 6 action to restrict the future use of fixtures with lead.

In addition, EPA has been working with the National Sanitation Foundation (NSF) to establish performance standards for newly manufactured brass faucets and fixtures. Only those faucets that are tested to show minimal leaching of lead will be certified by NSF. Some manufacturers are beginning to investigate lead-free metal alloy faucets, but it appears that it will be several years before these faucets are in widespread use. Until then, EPA believes that compliance with this final rule, as well as with NSF standards, will minimize lead exposure from brass faucets. The NSF standard will be part of a voluntary certification program for manufacturers of plumbing products and is expected to be adopted by most, if not all, States.

The preamble to the proposed rule presented information from several public water systems that collected lead tap samples before and after either raising pH, or raising pH in conjunction with adjusting alkalinity. Several commenters stated that the data presented did not demonstrate that the corrosion control treatments were effective because the majority of the data (Boston and Bennington) were from systems with lead service lines and that the systems had very high lead levels, which are not representative of the lead levels found throughout the country. They stated that the effectiveness of corrosion control in systems with lead levels in the range usually found—0.015 mg/L to 0.030 mg/L —was not proven. In addition, they criticized the use of the Seattle data because the samples were not collected in the same manner as required by the proposed rule.

EPA acknowledges that the Boston and Bennington data presented in the proposal came from homes with lead service lines and that the lead levels in many of the homes had very high lead levels before installation of corrosion control treatment. The data from Boston and Bennington, however, cannot be discounted simply because the systems have lead service lines. EPA estimates that about 20 percent of all public water systems, and about 30 to 35 percent of the systems that will initially exceed the lead action level, have some lead

service lines (EPA, 1991a). Thus, a large number of systems affected by this rule contain lead service lines. Data from other systems with lead service lines such as Fall River, New Bedford, and Chatham, Massachusetts, also had very high lead levels (EPA,1991b).

As has been widely documented, the corrosion control interventions in Boston and Bennington were effective (Karalekas et al., 1976, 1978, 1983; EPA, 1988f, 1991b; AWWA-RF, 1990). The 90th percentile lead levels in Boston were reduced from 0.110 mg/L (average of 0.058 mg/L) before pH and alkalinity adjustment, to 0.047 mg/L (average of 0.030 mg/L) 3 years after installation of treatment (Marcus, 1990a). Bennington reduced its 90th percentile lead levels from 0.148 mg/L (average of 0.105 mg/L) to 0.026 mg/L (average of 0.014 mg/L) 3 years after treatment (Marcus, 1990a). In Fall River, MA, the 90th percentile lead level was reduced from 0.250 mg/L (average 0.091 mg/L) before pH adjustment to 0.176 mg/L (average 0.034 mg/L) after treatment (Marcus, 1990a).

EPA also recognizes that the samples in Seattle were not collected exactly as the sampling protocol in the final rule. The final rule requires a 1000 ml first-draw sample, and Seattle used the first 250 ml for microbacterial analyses and the next 1000 ml for lead analysis. Nevertheless, the data are useful for determining the relative effectiveness of corrosion control treatment. Reductions in lead levels of about 60 percent after installation of treatment were obtained: for the Cedar River supply the 90th percentile lead level was reduced from 0.025 mg/L (average 0.010 mg/L) before treatment to 0.009 mg/L (average 0.004 mg/L) after treatment; the Tolt River supply showed reductions in the 90th percentile lead values from 0.025 mg/L (average 0.010 mg/L) to 0.011 mg/L (average 0.004 mg/L) (EPA, 1991b).

Several water systems have conducted sampling before and after application of inhibitors following initial sampling of 94 water districts in early 1988. The American Water Works Service Company (AWWSC) began an investigation into the effect of zinc orthophosphate on three districts (230, 340, and 130). Nine sites were sampled before and after treatment in District 230, four sites in District 340, and five sites in District 130. Average lead levels in first-draw tap samples in District 230 were reduced from 0.040 to 0.005 mg/L (88 percent reduction), District 340 showed reductions from 0.053 to 0.005 mg/L (87 percent reduction), and average first-draw lead levels in District 130 were reduced from 0.090 to 0.012 mg/L (91 percent reduction) (AWWSC, 1989). In Fairbanks, Alaska, morning first-draw tap samples were collected from 15 sites before, and 1 month after, treatment with sodium polyphosphate. Average lead levels were reduced from 0.077 to 0.035 mg/L (56 percent reduction) (AWWA-RF, 1990). These data and the data in Table 7 indicate that the addition of corrosion inhibitors can be effective for reducing lead levels in drinking water.

TABLE 7.—RELATIVE EFFECTIVENESS OF CORROSION CONTROL TREATMENTS

Corrosion control treatment	No. of systems	Percent of systems with 90th percentile levels below (mg/L)				
		0.005	0.010	0.015	0.020	0.030
Systems without Pb service lines: [1]						
No treatment	6	15	25	37	50	75
pH <8	11	21	34	49	67	87
pH >8	9	36	73	88	94	98
Inhibitors	13	34	65	80	88	95
Systems with Pb service lines [2]						
pH >8	5	16	20	24	28	38
Inhibitors	6	17	22	28	34	48

[1] First-draw samples from the following studies:
—28 systems from the American Water Works Service Company survey
—8 systems for the Technical Support Division (TSD/ODW) survey
—3 systems from public comments on the 1988 proposal.
[2] Data from service line samples from 11 systems, collected prior to proposal.

Several commenters were concerned that the singular reference to zinc orthophosphate in the proposed definition of corrosion inhibitors could be construed as an endorsement of this inhibitor at the expense of excluding many other effective inhibitors (e.g., polyphosphate, orthophosphate, blends of ortho- and polyphosphates, silicates, or sodium and zinc hexametaphosphate). Although the 1988 proposal identified zinc orthophosphate as the most effective inhibitor based on the available data, the Agency did not intend to imply that zinc orthophosphate was the only inhibitor a water system could use. The Agency has, therefore, deleted the reference to zinc orthophosphate for the rule's definition of corrosion inhibitor. To the extent that other inhibitors are able to reduce lead levels, they need to be considered.

Many commenters suggested that silicate-based inhibitors should be allowed, stating that they are effective in reducing lead and copper levels. Little research has been done with silicate-based inhibitors, and EPA is not aware of a water system that has used these inhibitors system-wide to reduce lead and copper levels (AWWA-RF, 1990). Some success was obtained, however, at a relatively high SiO_2 in pipe loop experiments by EPA (Schock, 1989). Water systems are permitted to test the effectiveness of silicate-based inhibitors during their corrosion control studies. Likewise, States are free to approve/designate silicate-based inhibitors if it can be determined that they are the most effective inhibitor for reducing the dissolution of lead and copper bearing materials.

EPA also analyzed data received during the public comment period and data received prior to the 1988 proposal to compare the effectiveness of available corrosion control treatments in reducing lead levels. These data confirm EPA's conclusion at proposal that implementation of corrosion control treatment can effectively reduce lead levels at the tap. The three primary sources for these analyses were the American Water Works Service Company Lead Survey, the EPA Office of Drinking Water's Technical Support Division Lead Survey (TSD), and the pre-proposal and public comment data base. EPA analyzed the three data sets in a paper "Influence of Plumbing, Lead Service Lines, and Water Treatment

Levels at the Tap" (EPA,1990e). This paper was made available for public review and comment through a Federal Register notice, published on October 19, 1990 (55 FR 42409). No comments were received on the analyses during the public comment period. The data and analyses are also discussed in the Occurrence and Treatment Support Document (EPA,1991b). A brief summary of the analyses is presented below along with the results in Table 7.

The majority of the systems in these data bases did not collect samples before and after installation of treatment. In an attempt to utilize this information, EPA screened the data that were collected using, as close as possible, the compliance monitoring criteria for the final rule: 1-liter first-flush samples (stagnation time of at least 6 hours) from homes with copper plumbing older than 5 years (to account for the effects of the 1986 ban on lead solder). Only systems with nine or more targeted samples were included in the analyses to increase the confidence in the estimates. Data from homes and systems with lead service lines were assessed separately from those without lead service lines. After applying these criteria to the data, 39 systems without lead service lines and 11 systems with lead service lines remained. Data from dozens of other utilities did not meet the criteria because collection methods consistent with the final rule were not used. For example, some systems did not collect 1-liter samples or collected samples after a standing time of only 2 hours.

The data from the 39 systems without lead service lines were divided into one of four "treatment" strata: (1) use of corrosion inhibitors, (2) pH adjusted to at least 8.0 at the treatment plant, (3) pH adjusted to between 7.0 and 8.0 at the plant, and (4) no treatment but pH was above 7 at the plant. The results given in Table 7 represent comparative estimates of treatment performance rather than precise predictions of systems' ability to meet the action level of 0.015 mg/L. The actual "pass/fail" rates among the entire water supply industry are expected to be different for a number of reasons, among which are the following:

- A relatively small number of systems are represented and are limited to mostly medium (and a few large) size systems, concentrated in the mid-Atlantic and Ohio River Valley.
- Data represent single samples. Other information indicates considerable temporal variability at the same tap. In addition, the majority of data were collected between January and March (AWWSC, 1989). Lead levels are generally lower in cold months; consequently, projected performance based on these data would tend to be overestimated.
- The range of important water quality parameters (e.g., alkalinity, hardness) of the raw water in these systems is relatively narrow. For example, most systems with pH $\geq$ 8.0 had total alkalinities in raw water between 20 and 50 mg/L as $CaCO_3$ (alkalinities can range from less than 10 mg/L to over 500 mg/L). Because the data are not representative of the range of water quality characteristics present throughout the United States, it is difficult to extrapolate, especially to large systems where the variability in pH can be significantly greater than in smaller systems.
- Only data from homes with plumbing older than 5 years at the time samples were taken were analyzed. The "greater than 5 years of age" stratification was used because selecting homes that would match the final targeting criteria exactly (homes with plumbing 5–10 years old) would have limited the analyses to less than 10 systems, which would have been insufficient to generate meaningful results. EPA chose to limit the analysis to houses with plumbing older than 5 years (as opposed to analyzing data from houses with plumbing of any age) to standardize the group of houses analyzed. Moreover, the age range reflects the fact that homes sampled under the final rule will likely have lead solder older than 5 years because of the effects of the 1986 SDWA lead solder ban. Lead levels in homes fitting the targeting criteria in the final rule (homes built after 1982, i.e., plumbing between 5–10 years of age) would be expected to be higher than in homes aggregated in the "older than 5 year" category since this latter category could have included much older homes with dissipated lead solder. This is another factor that tends to make performance projections based on these data optimistic.
- None of these systems were specifically trying to minimize lead or copper levels, although they were trying to reduce corrosion to some degree. This would tend to underestimate system performance projections based on these data.

Despite the data limitations, EPA believes the results in Table 7 represent trends indicative of the efficacy of the different treatments. Among systems with non-lead service lines, the data indicate that systems using corrosion inhibitors and maintaining a pH above 8.0 (at plant) would have a much higher likelihood of meeting the lead action level of 0.015 mg/L compared to systems in the other treatment strata. These data support conclusions discussed earlier that increasing pH and/or alkalinity, or adding a corrosion inhibitor, can effectively reduce lead levels in tap water.

The costs of pH adjustment, alkalinity adjustment, and corrosion inhibitor addition are summarized in Table 8. EPA believes the costs of these methods are reasonable and the methods are generally available for use by water systems. Costs may vary from those shown depending on local circumstances, but based on available information, the costs are representative of typical systems using these corrosion control treatments.

The corrosion control cost estimates were derived using the same assumptions and models as used for the proposed rule (adjusted for the new flow rates) with capital costs amortized over 20 years at a 10 percent interest rate and updated to reflect December 1988 engineering fees, contractor overhead and profit, and power, fuel, labor, and chemical costs. EPA also revised assumptions regarding flow rates to calculate all inorganic technology costs (EPA, 1987d) that result in increased cost estimates for corrosion control. A more detailed discussion on the procedures used in developing the cost estimates for these treatments can be found in the August 1988 proposal and in Lead and Copper in Drinking Water as a Result of Corrosion: Evaluation of Occurrence, Cost, and Technology (EPA, 1991b).

Several commenters submitted information on treatment costs for their systems. Unfortunately, the majority of systems did not present sufficient detail on critical elements, such as system design, flow rate, or chemical dosages, to enable EPA to compare the commenter's costing methodology with EPA's, or for EPA to modify its cost models as suggested by some commenters. The treatment costs from the few systems that did supply sufficient information generally supported EPA's estimates.

TABLE 8.—CORROSION CONTROL TREATMENT COSTS [1]

	Population served			
	<100	3,301–10,000	50,001–75,000	>1 million
Capital Costs ($ millions)				
pH adjustment:				
lime	3	152	518	978
caustic soda	3	44	93	731
calcite beds [2]	13			
Alkalinity adjustment:				
soda ash	3	56	119	1185
sodium bicarbonate	3	54	110	965
Corrosion inhibitor (e.g., zinc orthophosphate)	5	80	119	312
Total Production Costs (cents/1000 gallons or $/household/year) [3]				
pH adjustment:				
lime	86	12	3	1
caustic soda	66	6	3	3
calcite beds	114			
Alkalinity adjustment:				
soda ash	81	8	4	3
sodium bicarbonate	86	9	5	5
Corrosion inhibitor (e.g., zinc orthophosphate)	95	6	1	1

[1] Reference: EPA, 1991b.
[2] Systems serving greater than 500 people do not typically use calcite beds for adjusting pH.
[3] The cost per household per year can be calculated by multiplying production costs by 100. This assumes water consumption of 100,000 gallons per household per year.

Several commenters objected to using tap samples for measuring the effectiveness of corrosion control. These commenters were concerned that it would be difficult to ascertain whether a reduction in lead levels, measured at the tap after installing corrosion control, is a result of treatment or simply due to the aging of solder. They argued that water systems should be allowed alternative methods, such as the use of pilot plant studies or pipe loops to show the effectiveness of corrosion control.

EPA agrees that water systems should use pipe loops, metal coupon, partial system tests, or other evaluative schemes to assist in determining the most effective corrosion control treatment. The Agency encourages water systems investigating different corrosion control treatments to first conduct research in the laboratory, whenever possible, before implementing system-wide corrosion control, and it anticipates that the majority of systems serving greater than 50,000 people will follow such procedures. Although pipe loop and pilot plant studies can assist in planning a treatment strategy and predicting trends, they cannot be expected to predict the precise lead and copper levels at the tap for numerous reasons including: (1) The aging effects of pipe scales, (2) the nature of preexisting pipe deposits not governed by lead or copper chemistry alone, (3) differences in surface chemistry between new and used pipes or faucets, and (4) disturbances of deposits when pipe from the field is pulled and used in the laboratory tests. Thus, relying solely on laboratory studies to predict the effectiveness of corrosion control treatment would not indicate the levels of lead or copper at taps. Because of these problems and because EPA's goal is to reduce exposure to lead or copper in drinking water, it is essential to collect tap samples to determine if lead and copper levels at the tap decrease or increase after application of full-scale treatment and not to rely solely on laboratory studies to determine the effectiveness of treatment. Tap sampling after installation of corrosion control treatment is also necessary to evaluate whether lead service line replacement or additional public education is required.

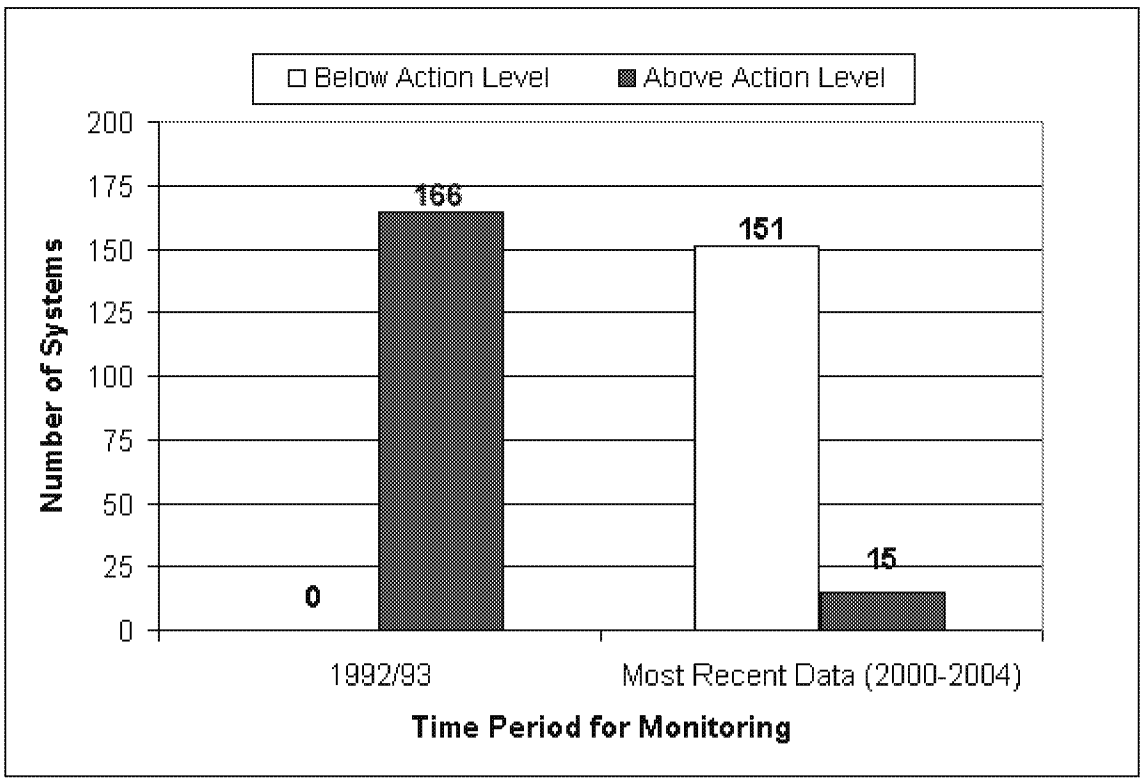
In terms of commenters concerned with the ability to differentiate between the effects of treatment and the aging of lead solder, the Agency believes that this should not be a problem because the final rule does not require systems to sample at homes with lead solder less than 5 years old, but only requires that lead solder have been installed after 1982. This is 4 years before the enactment of the lead ban in section 1417 of the SDWA and 6 years before the ban was to have been enforced by States. EPA believes that this criterion for monitoring will help assure that sites with the most recently installed lead solder (before the material was banned) are sampled and the potentially higher lead levels associated with these sites are found. However, because these sites will be greater than 5 years old, the effects on lead levels will be more readily associated with treatment as opposed to the aging effects of solder.

The data presented above show that increasing pH, and/or increasing pH in conjunction with alkalinity, or adding corrosion inhibitors can greatly reduce the levels of lead in tap water. These treatments have been used for many years by water systems to reduce corrosion in water distribution systems and the costs of these treatments are reasonable for large water systems (less than $6 per household per year). EPA, therefore, concludes that this treatment technology is feasible within the meaning of 1412(b)(5) of the SDWA. The data also indicate that the precise treatment efficacy of the different treatments will vary considerably between systems and even within systems, thereby reinforcing EPA's conclusion, discussed in Section IV(B), above, that it is not feasible to establish a single number as reflecting application of the best available treatment.

b. *Secondary Effects of Corrosion Control.* Numerous commenters stressed that corrosion control treatment must be designed and implemented to optimize overall water quality, not just to reduce lead and copper corrosion by-products. They contended that pH adjustment may result in a net decrease in public health protection due to increased levels of trihalomethanes and other disinfection by-products, increased precipitation of iron and manganese, and increased corrosion of galvanized piping in some water systems. Other commenters stated that an increase in pH could reduce the effectiveness of corrosion inhibitors. In addition, some commenters stated that phosphate-based inhibitors may promote bacterial and algal growth in reservoirs and other

Lead 90th Percentile Levels for 166 Large Water Utilities - Then and Now

After the rule was issued in 1991, water utilities were required to conduct initial monitoring for lead in 1992 and 1993. EPA reviewed data for 166 large water utilities that serve more than 50,000 and compared the results to the most recent monitoring data that utilities have reported to states (2000-2004). In their initial monitoring rounds, all 166 of the utilities were above the action level. During the most recent monitoring, only 15 of the 166 utilities exceeded the 15 ppb action level, demonstrating that corrosion control efforts taken by the utilities have largely been effective in controlling lead levels.



System Specific Information

(Data in italics are from 1992/93 press releases, all other data from SDWIS/FED)

State	Water System	90th Percentile Round 1 - 1992/93 (ppb)	90th Percentile Round 2 - 1992/93 (ppb)	90th Percentile - Most Recent Level in SDWIS (ppb)	SDWIS Monitoring Period Start Date	SDWIS Monitoring Period End Date
AR	Jonesboro	26	37	1	1/1/2001	12/31/2001
AZ	Phoenix Mun. WS	19	11	1	1/1/2003	12/31/2003
CA	Cal Water Service - San Mateo	18	25	10	1/1/2002	12/31/2004
CA	CalWater Service - Livermore	80	8	0	1/1/2001	12/31/2003
CA	City of Mountain View	8	22	4	1/1/2003	12/31/2005
CA	Milpitas	23	23	5	1/1/2001	12/31/2003

CA	Palo Alto	30	16	1	1/1/2003	12/31/2005
CA	Pleasanton	20	2	3	1/1/2001	12/31/2003
CA	Redwood City	28	19	8	1/1/2002	12/31/2004
CT	Metro. (Hartford)	40		12	1/1/1999	12/31/2001
DC	Washington Aqueduct/DC WASA	18	39	59	1/1/2004	6/30/2004
FL	BCOES 1A (Pompano Beach)	84	35	28	1/1/2004	6/30/2004
FL	City of Ormond	24	24	10	1/1/2002	12/31/2002
FL	City of Port St. Lucie utl.	41	25	6	1/1/2003	12/31/2003
FL	Cocoa	32	14	2	1/1/2002	12/31/2002
FL	Coral springs	18	4	0	1/1/2002	12/31/2002
FL	Daytona Beach	24	20	6	1/1/2002	12/31/2002
FL	Escambia County	175	18	2	1/1/2001	12/31/2003
FL	Fort Myers W.D.	34	43	2	1/1/2003	12/31/2003
FL	Indian River Co Util	29	14	3	1/1/2002	12/31/2002
FL	Miami Beach, City of	27	4	8	1/1/2001	12/31/2001
FL	Miramar (E& W) plant	47	67	0	1/1/2001	12/31/2001
FL	Panama city Beach	23	9	4	1/1/2001	12/31/2001
FL	Port of orange	22		4	1/1/2003	12/31/2003
GA	Augusta-Richmond County	48	36	3	1/1/2003	12/31/2003
GA	Clayton County	34	20	14	1/1/2002	12/31/2002
GA	Cobb Co.-Marietta	22		3	1/1/2003	12/31/2003
GA	Douglasville-Douglas Co.	30	22	3	1/1/2001	12/31/2001
GA	Gwinnett Co.	66	22	6	1/1/2003	12/31/2003
GA	Macon-Bibb County	17	20	3	1/1/2003	12/31/2003
GA	North Fulton	53	25	3	1/1/2003	12/31/2003
GA	Paulding County WS	30		3	1/1/2003	12/31/2003
GA	Savannah- Main	21		4	1/1/2003	12/31/2003
GU	Publ. Util. Agency of Guam	25		1	7/1/2003	6/30/2004
HI	Pearl Harbor	25	3	0	1/1/2001	12/31/2001
IA	Cedar Rapids	80	42	6	1/1/2003	12/31/2003
IA	Des Moines	21	10	0	1/1/2000	12/31/2002
IL	Berwyn	33	17	8	1/1/2000	12/31/2002
IL	Bloomington	18	7	1	1/1/2000	12/31/2002
IL	Chicago	10	20	7	1/1/1999	12/31/2001
IL	Cicero	29	9	7	1/1/2000	12/31/2002
IL	City of Aurora	9	16	10	1/1/2004	6/30/2004
IL	City of Elgin	13	18	12	1/1/2001	12/31/2001
IL	Decatur	37	13	0	1/1/2000	12/31/2002
IL	Evanston	25	7	10	1/1/2000	12/31/2002
IL	Glenview	24	22	6	1/1/2000	12/31/2002
IL	IL American (E. St. Louis)	19	11	3	1/1/1999	12/31/2001
IL	Joilet	22	23	12	1/1/2000	12/31/2002
IL	Oak Lawn	19	24	7	1/1/2000	12/31/2002
IL	Oak Park	39	29	0	1/1/2001	12/31/2003
IL	Palatine	18	22	0	1/1/2000	12/31/2002
IL	Waukegan	20	18	0	1/1/2000	12/31/2002
IN	Fort Wayne	21		15	1/1/2002	12/31/2004
IN	Hammond	22	23	2	1/1/2002	12/31/2002
MA	Boston Water & Sewer (MWRA)	48	47	15	1/1/2004	6/30/2004

MA	Brookline Water Dept. (MWRA)	62	72	15	7/1/2003	12/31/2003
MA	Centerville Osterville Marston Mills WD	23	23	11	1/1/2001	12/31/2001
MA	Chicopee Water Dept.	69	110	2	1/1/2001	12/31/2001
MA	Dennis water district	93		2	7/1/1999	6/30/2002
MA	Falmouth Water dept	40	40	23	7/1/2001	12/31/2001
MA	Framingham water Div. (MWRA)	100	64	15	7/1/2003	12/31/2003
MA	Haverhill WD	30		4	1/1/2003	12/31/2003
MA	Lowell Regional Water Utl.	51	39	7	1/1/2002	12/31/2002
MA	Malden Water Division (MWRA)	71	60	15	7/1/2003	12/31/2003
MA	Medford Water Dept. (MWRA)	70	113	15	7/1/2003	12/31/2003
MA	Newton Water Dept. (MWRA)	163	123	15	7/1/2003	12/31/2003
MA	Quincy Water Dept. (MWRA)	62	27	15	7/1/2003	12/31/2003
MA	Somerville Water Dept. (MWRA)	84	35	15	7/1/2003	12/31/2003
MA	Springfield Water & Sewer	36	35	9	1/10/2002	12/31/2002
MA	Waltham Water Div. (MWRA)	52	76	15	7/1/2003	12/31/2003
MA	Weymouth Water Dept.	23	32	15	1/1/2001	6/30/2001
MA	Worcester D.P.W	40	32	8	1/1/2003	12/31/2003
MD	Howard County dpw distr.	20	13	7	1/1/2002	12/31/2002
MD	Washington suburban sanitary comm.	38	14	4	1/1/2002	12/31/2002
ME	Portland Water Dist.	70	54	6	1/1/2003	12/31/2003
MI	Clinton Township	19	14	0	1/1/2002	12/31/2002
MI	Dearborn	29	28	6	1/1/2002	12/31/2002
MI	Dearborn Heights	33	41	3	1/1/2002	12/31/2002
MI	Detroit	21	15	12	1/1/2002	12/31/2002
MI	Farmington Hills	17	11	0	1/1/2002	12/31/2002
MI	Grand Rapids	35	37	4	1/1/2001	12/31/2001
MI	Livonia	34	15	6	1/1/2002	12/31/2002
MI	Macomb- Bibb Township	34	21	0	1/1/2002	12/31/2002
MI	Royal Oak	17	24	10	1/1/2001	12/31/2001
MI	St. Clair Shores	23	23	2	1/1/2002	12/31/2002
MI	Taylor	35	69	12	1/1/2002	12/31/2002
MI	Warren	21	16	1	1/1/2002	12/31/2002
MI	Westland	21	31	9	1/1/2002	12/31/2002
MN	Minneapolis	19	32	6	1/1/2003	12/31/2003
MN	St. Paul	54	28	11	1/1/2003	12/31/2003
NC	Asheville-Buncombe	29	27	0	1/1/2003	6/30/2003
NC	Fayetteville PW Comm.	12	18	12	1/1/2002	6/30/2002
NC	Gastonia	17	8	0	7/1/2002	12/31/2002

NC	Hendersonville	29	19	16	7/1/2003	12/31/2003
NC	Wilmington WS	10	16	1	1/1/2002	6/30/2002
NJ	Bayonne W.D.	18	25	25	7/1/2002	12/31/2002
NJ	Jersey City (United Water-Jersey City)	84	58	84	7/1/2002	12/31/2002
NJ	Liberty Water	28	32	7	7/1/2003	12/31/2003
NJ	Newark W.D. - Wanaque	27	23	27	7/1/2002	12/31/2002
NJ	Newark W.D.- Pequannock	27	23	27	7/1/2002	12/31/2002
NJ	NJ American - Short Hills	25	11	25	7/1/2002	12/31/2002
NJ	Old Bridge MUA	5	42	42	7/1/2002	12/31/2002
NJ	Passaic Valley W.C.	24	30	14	7/1/2003	12/31/2003
NJ	Trenton W.D.	18	14	18	7/1/2002	12/31/2002
NJ	Wayne Twp. Div. Of W.	30	18	5	7/1/2003	12/31/2003
NY	Binghamton	20	7	7	1/1/2000	12/31/2002
NY	Buffalo City Div. of Water	13	19	7	1/1/2000	12/31/2002
NY	Elmira Water Board	20	16	10	1/1/2003	12/31/2003
NY	Jamaica Water (NYC)	20	25	11	1/1/2003	12/31/2003
NY	Mount Vernon	62	61	6	1/1/2001	12/31/2001
NY	New Rochelle Water	36	36	11	1/1/2001	12/31/2001
NY	NYC-Catskills/delaware system	55	20	11	1/1/2003	12/31/2003
NY	Onondaga County	20		6	1/1/2000	12/31/2002
NY	Syracuse	50	40	17	7/1/2003	12/31/2003
NY	Utica Board of Water	100	160			
NY	White Plains City	57		4	1/1/2002	12/31/2002
NY	Yonkers	68	110	22	1/1/2004	6/30/2004
OH	Cleveland - Baldwin/Nottingham Plants	25	27	6	1/1/2003	12/31/2005
OH	Cleveland - Morgan/Crown Plants	20	15	7	1/1/2003	12/31/2005
OH	Columbus	15	16	1	1/1/2002	12/31/2002
OR	Beaverton	27	9	3	1/1/2001	12/31/2001
OR	Portland, City of	41	53	8	7/1/2003	6/30/2006
OR	Rockwood (customer of Portland)	37	12	8	7/1/2003	6/30/2006
OR	Tualatin Valley (customer of Portland)	28	29	8	7/1/2003	6/30/2006
PA	Bensalem Township (psw bensalem)	29	14	2	1/1/2001	12/31/2001
PA	City of Lancaster Auth.	41	25	7	1/1/2001	12/31/2001
PA	Greater Johnstown W. A.	21	7	13	1/1/2001	12/31/2001

PA	Lower Buck Co. Joint	37	53	1	1/1/2001	12/31/2001
PA	pawc watres	69	87	3	1/1/2001	12/31/2001
PA	Philadelphia Water Dept.	22	15	13	1/1/2002	12/31/2002
PA	Westmoreland Co. Yough	56	6	4	1/1/2001	12/31/2001
PA	Westmd mun auth-sweeney plant	25		11	1/1/2001	12/31/2001
PA	Williamsport Mun. Auth	51	11	4	1/1/1999	12/31/2001
PA	York Water Co.	9	17	2	1/1/2001	12/31/2001
PR	Caguas Sur	20	16	5	7/1/2003	12/31/2003
PR	Fajardo Ceiba	60	44	8	7/1/2003	12/31/2003
PR	Juncos - Cieba sur	20	20	4	7/1/2003	12/31/2003
PR	Metropolitano	16	6	21	7/1/2003	12/31/2003
PR	Rio Baja, Vieq	29				
PR	Rio Blanco, vieques, Culedra	20	8	18	7/1/2003	12/31/2003
RI	Pawtucket	29	6	7	1/1/2001	12/31/2001
SC	Charleston, City of	211	165	4	1/1/2003	12/31/2003
SC	Columbia, City of	40	114	6	1/1/2002	12/31/2002
SC	Orangeburg DPU	18	10	4	1/1/2002	12/31/2002
SC	Summerville	35	10	3	1/1/2000	12/31/2002
TN	Hixson Utility District	16	16	2	7/1/2001	6/30/2003
TN	Jackson WS	15	20	2	7/1/2000	6/30/2002
TX	City of Frisco	20		2	1/1/2000	12/31/2002
TX	City of McKinney	19	9	3	1/1/2000	12/31/2002
TX	Galveston	18	6	2	1/1/2000	12/31/2002
TX	Port Arthur	28	42	3	1/1/2001	12/31/2003
TX	Texas A & M Main Campus	142	9	2	1/1/2000	12/31/2002
VA	City of Chesapeake	30	9	4	1/1/2001	6/30/2001
VA	City of Portsmouth	26	3	1	1/1/2002	12/31/2004
VA	City of Richmond	16	25	4	1/1/2000	12/31/2002
VA	Occoquan-Woodbridge	22	30	3	1/1/2001	12/31/2001
VT	Champlain	23	23	11	6/1/2002	12/31/2002
WA	Bellingham Water Div.	23	19	6	1/1/2000	12/31/2002
WA	Bremerton Mnpl Utility	14	17	7	1/1/2002	12/31/2002
WA	Everett Publ. Works	23	13	3	1/1/2001	12/31/2003
WA	Seattle Water Dept	19	20	10	1/1/2004	6/30/2004
WA	Tacoma	32	17	12	1/1/2001	12/31/2003
WI	Madison Waterworks	16		Madison is replacing all lead service lines		
WI	Milwaukee Waterworks	14	26	10	1/1/2003	12/31/2003
WI	Oshkosh Waterworks	17	14	8	1/1/2002	6/30/2002
WI	Racine Waterworks	18		14	1/1/2003	12/31/2003
WI	Sheboygan Water Utilities		19	7	1/1/2002	12/31/2002
WI	West Allis Waterworks	22		5	1/1/2002	12/31/2002
WY	Cheyenne Board Public Utls	10	17	8	1/1/2000	12/31/2002

Total Systems with values		**166**	**151**	**166**
Systems > Action Level	152	106	15	
Percent Systems w/values > AL	92%	70%	9%	

Analysis of Impacts of Corrosion Control Treatment on Lead and Copper Levels over Time

Summary

Under the Lead and Copper Rule (LCR), water systems are required to collect lead and copper samples at interior taps (e.g., a customer's kitchen or bathroom sink). These "tap" samples are used to help determine whether corrosion control treatment (CCT) is needed to reduce water corrosivity to minimize leaching of lead and copper from plumbing materials. Tap monitoring began in 1992 for systems serving more than 3,300 people and in 1993 for water systems serving 3,300 or fewer people.

In this white paper, EPA presents its evaluation of two important research questions: whether lead and copper levels have declined over time from 1992 to 2008 and whether any decline can be attributed to CCT. Note that the purpose of EPA's analysis was to evaluate the effectiveness of CCT in general, not to examine the effectiveness of specific CCT techniques. This paper also includes a background section that summarizes tap monitoring requirements and the CCT steps; a description and the limitations of the two data sources used for the analyses; and three appendices: Appendix A describes the procedure for estimating the date of CCT installation; Appendix B describes the quality assurance review of the Six-Year Review data; and Appendix C includes a discussion of the parametric statistical model used to assess the effect of CCT on lead and copper levels.

For its analysis, EPA reviewed lead and copper 90th percentile values, milestones, violations, and treatment data reported to the federal State Drinking Water Information System (SDWIS/Fed). As a check on the robustness of these findings, EPA also reviewed lead and copper sample results that some states voluntarily reported for EPA's Six-Year Review process. Data quality (e.g., reporting of incorrect units and dates) and completeness constraints were noted in both data sources, which impacted the accuracy of EPA's assessment.

Approximately 10% of small water systems and 30 % of medium water systems are required to install CCT compared to about 93% of large systems water systems that are required to install CCT. Less than 1% of small and medium water systems and no large water systems have unresolved CCT violations.

Based on the available data, EPA observed an overall decline in lead and copper levels during 1992 through 2008. EPA conducted modeling to assess whether this decline could be attributed to CCT and whether the length of time that CCT had been in place influenced the observed lead and copper levels. Based on its analysis, EPA concluded that some of the decreases in these levels occur in systems without CCT. EPA's model also indicated a statistically significant decline in the

median lead and copper 90th percentile level as a result of CCT across system size categories. The magnitude of the decline ranged from just below 10% for median copper 90th percentile levels for medium systems to more than 40% for median lead 90th percentile levels for small water systems.

When the model was adapted to allow for delayed responses to CCT, the effects grew over time for small systems; in contrast, medium and large systems appear to exhibit an overshooting effect: CCT initially produces a dramatic drop within the first year or two following CCT installation but then rebounds to a higher level that is still lower than the pre-CCT level.

I. Background

The Lead and Copper Rule (LCR) was promulgated to protect public health by minimizing lead and copper levels in drinking water, primarily by reducing water corrosivity. Because lead and copper in drinking water is mainly due to the corrosion of distribution and household plumbing materials, all community water systems (CWSs) and nontransient noncommunity water systems (NTNCWSs) are required to collect first-draw samples at kitchen or bathroom taps of residences and other buildings (i.e, "tap" samples). This sampling requirement began in 1992 for those water systems serving more than 3,300 people and in 1993 for those serving 3,300 or fewer people (see Exhibit I-1 below for the three size categories defined by the LCR and the schedule for initial monitoring).

Exhibit I-1. LCR System Size Categories and Schedule for Initial Monitoring

Size Category		1st Initial Monitoring Period [1]	2nd Initial Monitoring Period
System Size	Population Served		
Large	More than 50,000	1/1/92 - 6/30/92	7/1/92 - 12/31/92
Medium	3,301 to 50,000	7/1/92 – 12/31/92	1/1/93 - 6/30/93 *
Small	25 to 3,300	7/1/93 – 12/31/93	1/1/94 - 6/30/94 *

* Required if either action level is not exceeded during the 1st initial monitoring period, or if required by the state.

The number of samples to be collected by each water system is based on the population served by the water system and whether the system is on standard or reduced monitoring (see Exhibit I-2 below). The lead and copper tap monitoring results are used to calculate 90th percentile lead and copper levels. The 90th percentile levels are compared to their respective action levels of 0.015 mg/L for lead or 1.3 mg/L for copper.[1] All water systems that exceed the lead or copper action

[1] The 90th percentile is calculated by arraying the lead (or copper) sample results from lowest to highest and multiplying the number of valid samples by 0.9. For example, a water system that is required to collect 10 samples will use its 9th highest lead and copper test results as the 90th percentile level (i.e., 0.9 x 10 = 9). For 5 samples, the 90th percentile is computed as the average of the 4th and 5th highest results. For fewer than 5 samples, the highest result is used.

level must initiate corrosion control treatment (CCT) steps. The steps to be completed (e.g., corrosion control study) and their timeline are dependent on the water systems size category (see Exhibit I-3).

Exhibit I-2. Minimum Number of Required Tap Samples by Size

System size *(population served)*	Standard Monitoring *Frequency: Six-months*	*Reduced Monitoring Frequency: Annual, Triennial, or Every 9 Years*
	Number of sites	Number of sites
>100,000	100	50
10,001 - to 100,000	60	30
3,301 - to 10,000	40	20
501 - to 3,300	20	10
101 to 500	10	5
≤100	5	5

Notes:

1. Annual monitoring applies if for 2 consecutive 6-months, the water system is at or below both action levels (applies to ≤ 50,000 people only) or operates its CCT in accordance with its State-specified optimal water quality parameters (applies to any size system with CCT).
2. Triennial monitoring applies if: the criteria listed in Note 1 are met for 3 consecutive years; system meets b3 criteria (see footnote 2); or system qualifies for accelerated reduced monitoring because 90th percentile lead level is ≤ 0.005 mg/L and 90th percentile copper level is ≤ 0.65 mg/L for two consecutive, six-month periods (accelerated reduced provision was added by the 2000 LCR Revisions).
3. 9-year monitoring waiver is available to systems serving ≤3,300 that meet specific non-lead and non-copper plumbing criteria and have lead and copper 90th percentile levels that are at or below 0.005 mg/L and 0.65 mg/L, respectively (waiver provision was added by the 2000 LCR Revisions).

Large water systems that did not have CCT in place prior to the rule's effective date of December 7, 1992 were required to install it by January 1, 1997, regardless of whether they exceeded the lead or copper action level (with an exception).[2] Smaller water systems are required to install CCT only if they have continuing exceedances of their lead or copper action level. Small and medium water systems can discontinue CCT steps if they are at or below both action levels for two consecutive six-month monitoring periods. However, if they have installed CCT, they must continue to operate it. These water systems must recommence CCT anytime they have a lead or copper action level exceedance, beginning with the first uncompleted step or as required by the state.

[2] Large water systems in which the difference between their lead tap samples and highest source water sample results are less than 0.005 mg/L are not required to install CCT (also known as "b3" systems).

Exhibit I-3 shows the schedule for completing CCT steps for those systems that are subject to these requirements.

Exhibit I-3. Corrosion Control Treatment Steps		
Requirement	**Timetable for Completing Corrosion Control Treatment for Systems Serving:**	
	50,000 or fewer people	**More than 50,000**
Step 1: System recommends type of treatment to be installed	6 months	N/A (Part of corrosion control study)
Step 2: State decides whether CCT study is necessary	12 months	N/A (System required to conduct study)
Step 3: System completes study	18 months after State decision to conduct study	July 1, 1994
Step 4: State determines type of treatment to be installed	1. **If study is required:** 6 months after study is completed 2. **If no study is required:** Serves ≤ 3,300: 24 months; Serves 3,301 - 50,000: 18 months	January 1, 1995
Step 5: System installs treatment	24 months after State decision regarding type of treatment to be installed	January 1, 1997
Step 6: System conducts follow-up monitoring	12 months after treatment installation (2 consecutive 6-month periods)	January 1, 1998
Step 7: State designates CCT operating parameters, known as optimal water quality parameters or OWQPs	6 months after follow-up monitoring	July 1, 1998
Step 8: System conducts continued monitoring	The schedule based on whether an action level is exceeded and/or compliance with OWQP ranges or minimums	
Source: Based on Table I-1: *Corrosion Control Treatment Steps in Lead and Copper Monitoring and Reporting Guidance for Public Water System*. EPA-816-R-02-009, February 2002.		

II. Data Sources Used for the Analyses

EPA reviewed lead and copper 90th percentile values, milestones, violations, and treatment data reported to the federal version of the Safe Drinking Water Information System (SDWIS/Fed) for 1992-2008, and Six-Year Review lead and copper sample results for 1998-2005. A more detailed discussion of these two data sources is presented below.

A. SDWIS/Fed

SDWIS/Fed stores drinking water information reported by states to EPA that pertain to PWS inventory, violations, and enforcement actions. Unlike the state version of SDWIS (SDWIS/State) and other state databases, SDWIS/Fed does not include analytical results from individual samples (with the exception of some unregulated data and concentrations for contaminants that exceed

the maximum contaminant level (MCL)). For the LCR, some 90th percentile levels are required to be reported (see 90th Percentile Data below for more detail).

For this white paper, EPA reviewed inventory, 90th percentile lead and copper data, milestone records, two LCR violation types, and treatment information that were reported to SDWIS/Fed (current through June 30, 2009) for 1992-2008. The data were downloaded from SDWIS/Fed on October 1, 2009. Each of these categories of data is described below including their relevance to the analyses presented in Section III.[3]

Inventory

EPA reviewed public water system (PWS) type, status (active or inactive), and population served records that were reported to SDWIS/Fed as of June 30, 2009. These data were used to identify the following universe of water systems to be included in the analysis:

- Active systems or inactive systems with LCR data for 1992-2008.
- CWSs and NTNCWSs that serve 25 or more people.

90th Percentile Data

Individual lead and copper tap sampling results are not reported to SDWIS/Fed -- these data are maintained at the state level. States are required to report to SDWIS/Fed:

- any 90th percentile value that exceed the lead action level of 15 ppb or copper action level of 1.3 mg/L for all system sizes; and
- 90th percentile lead values at or below the lead action level (i.e., non-exceedances) for water systems serving more than 3,300 people only.

States are not required to report copper 90th percentile non-exceedances for any size water system or 90th percentile lead non-exceedances for water systems serving 3,300 or fewer people.[4]

For this analysis, 90th percentile data were plotted for each of the three size categories for 1992-2008 and were used as a measure for identifying changes in lead and copper levels over time (refer to Exhibits III-2A and III-2B in Section III).

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[3] Ohio's data was excluded from the SDWIS/Fed dataset after a review of the state's lead and copper 90th percentile records, which in several instances, appeared to be reported in the wrong units. For similar reasons, Georgia's copper 90th percentile results were also excluded.

[4] The description of the 90th percentile reporting requirements in the paragraph above reflects those specified by the 2000 revisions to the LCR. The requirement to report exceedances to SDWIS/Fed is unchanged from the original rule; however, prior to 2000 revisions, EPA requested 90th percentile non-exceedances for lead be reported to SDWIS/Fed for all large systems, and for medium and small systems once they exceeded the lead action level.

Treatment Data

States must report in SDWIS/Fed treatment information for each treatment plant. EPA identified those water systems with a treatment objective code of "C", which denotes CCT. One limitation of the data is that the date that is associated with the treatment information indicates when the state reported the record to SDWIS/Fed, not necessarily when the treatment was installed by the water system. Thus, the treatment information was used in combination with milestone and violation information to establish the date of CCT installation (refer to Appendix A).

Milestones

Three milestones, Deem, Done, and LSLR are reported to SDWIS/Fed to indicate the initiation or completion of key requirements of the LCR. Because of the ambiguity with the date associated with the treatment objective code of "C", EPA used the milestones in combination with treatment and violation information to help identify those water systems that had or were required to install CCT, and to approximate when treatment was installed. Each milestone is described in more detail below.

- **"Deem"** represents the basis for the State's determination that a system is "deemed" to be optimized under the LCR. Three reason codes are to be reported with this milestone to explain how a system is deemed. Systems with a reason code of WQP have installed CCT.

Exhibit II-1. Reason Codes	
Reason Code	**To Be Reported When:**
B1	A PWS serves ≤ 50,000 and is at or below both action levels for 2 consecutive, 6-month monitoring periods.
WQP	1. A PWS has installed CCT prior to the December 7, 1992; or 2. The State has designated optimal water quality parameters (OWQPs) that define how CCT must be operated.
B3	A PWS that serves > 50,000 people and has minimal levels of corrosion in its distribution systems.

Source: Based on EPA's October 2001 guidance, Appendix B - LCRMR Reporting Guidance

- **"Done"** indicates when a water system has completed all required steps to reduce lead and/or copper levels including implemented optimal corrosion control (i.e., the date the state set OWQPs), completed installation of source water treatment and/or replaced lead service lines (LSLs). The date to be reported corresponds to the latest event that the system was required to complete. Note that in EPA's original October 2001 reporting guidance for the Lead and Copper Rule Minor Revisions (LCRMR), reason codes were not to be reported with the Done milestone; however, the September 2007, Minimum Reporting

Requirements for the Safe Drinking Water Information System (SDWIS/FED) indicates that these codes may be optionally reported for the Done milestone. In addition, as explained in Appendix A, the 2007 guidance redefines the Deem and Done milestones and reason codes.

- **"LSLR"** indicates water systems that are required to initiate lead service line replacement and when this replacement is scheduled to begin.

The lack of a milestone that corresponds directly to the date of CCT installation, changes to milestone reporting requirements and related guidance, and inconsistencies within and among states' interpretation and reporting of these milestones complicate the determination of when CCT was installed. In addition, a system's status can change based on whether the lead or copper action level is exceeded or a system no longer meets its OWQPs. Thus, multiple Done, Deem, and/or LSLR milestones may be reported for the same water system to reflect this change.

For its analysis, EPA used the Done and Deem milestones in combination with treatment and violation information to help identify those water systems that had or were required to install CCT and to approximate when the treatment was installed. This approach is provided in Appendix A.

Violations

States are required to report violations for a water system's failure to meet monitoring or treatment technique requirements. EPA determined the percentage of systems that had one or more lead and copper tap monitoring and reporting (M/R) violations during 1992-2008 to indicate the number of water systems that did not monitor and could potentially have had 90th percentile lead or copper action level exceedances (see Exhibit III-5 in Section III).

Similarly, to provide a more complete picture of the universe that is required to install CCT, EPA also calculated the percentage of systems with unresolved CCT violations as of June 30, 2009. EPA also used the date that a system resolved its CCT violation as one criterion for identifying the date that a system installed CCT (refer to Appendix A).

B. Six-Year Review ICR Dataset

In 2006, EPA prepared an information collection request (ICR) for states to submit compliance monitoring data that were collected by water systems between January 1998 and December 2005. As discussed above, state databases contain individual sample monitoring records as opposed to SDWIS/Fed that includes summary level data (i.e., for lead and copper, 90th percentile levels only). The purpose of this voluntary ICR data request was to help EPA with its charge under the Safe

Drinking Water Act to review existing National Primary Drinking Water Regulations (NPDWRs) at least once every six years, and if appropriate, revise them (i.e., the Six-Year Review).

Forty-three states submitted individual lead sample monitoring data and 41 states submitted individual copper monitoring data. In addition, two EPA Regions also provided individual lead and copper sample results. These data are collectively known as the "Six-Year Review-ICR dataset".[5] The Six-Year Review-ICR dataset does not include 90th percentile level calculations – that information is available from SDWIS/Fed.

EPA plotted the Six-Year Review-ICR sample data for 1998-2005 for each size category as another measure for identifying changes in lead and copper levels over time (refer to Exhibit III-3 in Section III). Refer to Appendix B for description of the EPA's quality assurance review of the Six-Year Review-ICR dataset.

III. Summary of Analyses Conducted

Section III presents analyses related to inventory, 90th percentile lead and copper levels, lead and copper sample data, lead and copper tap monitoring and reporting (M/R) violations, and CCT installation and violation data. This section is divided into the following subsections:

- Distribution of Size Categories in SDWIS/Fed and Six-Year Review-ICR Datasets.
- Lead and Copper Action Level Exceedance Percentages over Time.
- Lead and Copper Levels in Individual Sample Results above the Action Level.
- Correlation between SDWIS/Fed and Six-Year Review Lead and Copper Data.
- Lead and Copper Tap Monitoring and Reporting Violations.
- Corrosion Control Treatment Trends.

Because the rule requirements and resources vary by size category, the exhibits within each of these subsections, in general, display data by each of the three main LCR size categories of large (serve >50,000 people), medium (serve 3,301-50,000 people), and small (serve 3,300 or fewer people). Note that the inventory in SDWIS/Fed is updated quarterly and that the exhibits that display SDWIS/Fed data are based on the SDWIS/Fed inventory that is current through June 30, 2009.

Distribution of Size Categories in SDWIS/Fed and Six-Year Review-ICR Datasets

[5] States not represented include Florida (provided lead results only), Kansas, Louisiana, Maryland, Mississippi, New Hampshire, Pennsylvania, Tennessee (provided one lead result and no copper results), and Washington.

Exhibits III-1A and 1B below display the percent and number of CWSs and NTNCWSs in each of the three LCR size categories in SDWIS/Fed and the Six-Year Review-ICR dataset, respectively. Although the Six-Year Review data set is based on a smaller universe of water systems (i.e., is limited to those 43 states and 2 Regions that provided some lead or copper data), the distribution of systems among the size categories between the two datasets is almost identical. Small water systems comprise the vast majority of water systems in both datasets (89% in SDWIS/Fed and 86% in Six-Year), followed by medium systems at 10 and 12%, and large water systems at 1% and 2%.

Exhibit III-1A. Percent and Number of PWSs in SDWIS/Fed by the Three LCR Size Categories

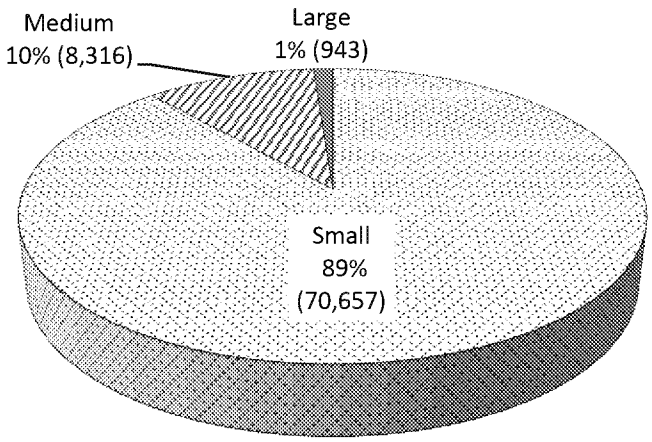
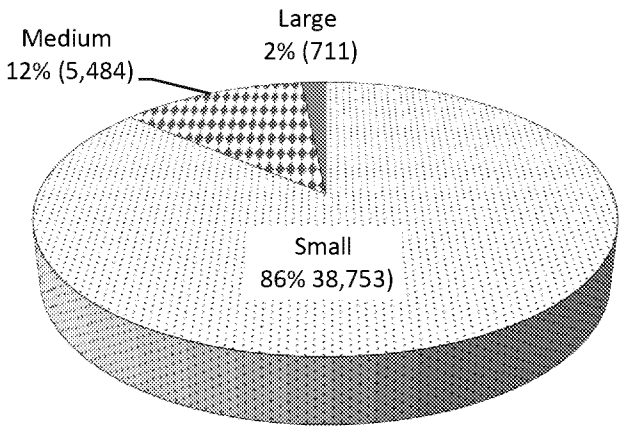


Exhibit III-1B. Percent and Number of PWSs in Six-Year Review-ICR Dataset by the Three LCR Size Categories



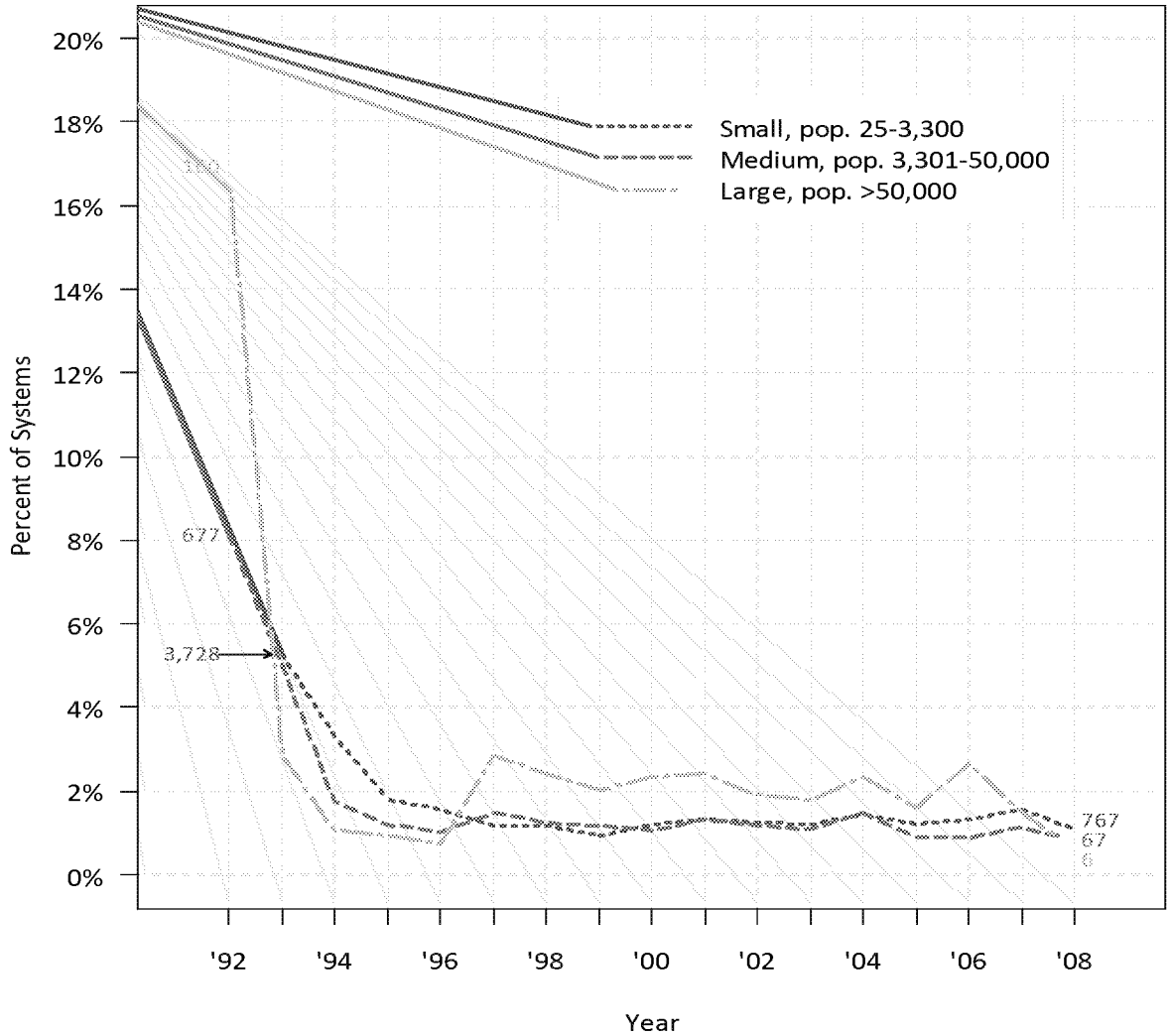
Sources: Exhibit III-1A -- Six-Year Review-ICR Dataset (1998-2005) for 43 states and tribal water systems in EPA Regions 8 and 9; Exhibit III-1B -- October 1, 2009 download from SDWIS/Fed, current through June 30, 2009, and exclusive of Ohio's inventory.
Note: Both pie charts exclude PWSs that were listed as TNCWSs with lead and copper data.

Lead and Copper Action Level Exceedance Percentages over Time

Exhibit III-2A displays the percent of water systems by size category with one or more 90th percentile lead values that are above the lead action level of 0.015 mg/L for a given year during 1992-2008, as reported to SDWIS/Fed. Exhibit 2B presents similar information for copper 90th percentile values that are above the copper action level of 1.3 mg/L. Water systems on semi-annual monitoring with two action levels exceedances are counted once. For systems on triennial monitoring, the 90th percentile lead or copper level is plotted in the last year of the monitoring period.[6] For example, a 90th percentile level that was based on monitoring conducted during January 1, 2002 through December 31, 2004, was plotted as a 2004 result.

Exhibit III-2A. Percent of PWSs by Size Category with Lead Action Level Exceedances during 1992-2008 based on SDWIS/Fed Data

[6] The actual sample date is not reported to SDWIS, only the dates for the beginning and end of the monitoring period. Thus, EPA assumed that monitoring occurred in the last year of the monitoring period.



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009, and exclusive of Ohio's data.

Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data.

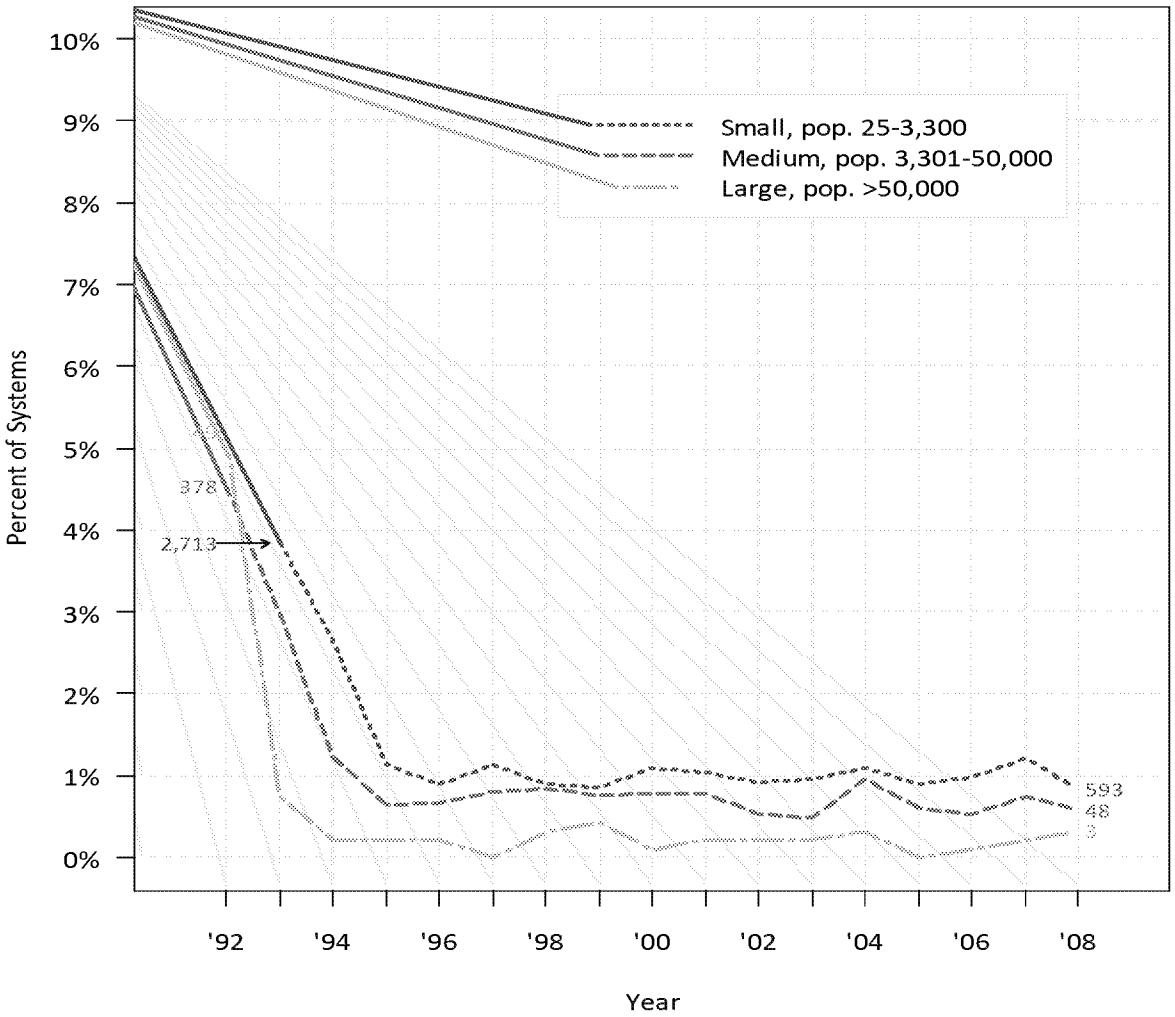
2. Small water systems were not required to begin monitoring until 1993.

3. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

As indicated by the graph above, the largest percentage of lead action level exceedances occurred during the first year of monitoring for all system sizes. Large water systems show the highest percentage of exceedances during the first year. This may be attributed to better reporting for these water systems, partly in response to an EPA press release that identified large water systems that had exceeded the lead action level based on their initial 1992 monitoring data. Another possibility is that large systems are more likely to have lead service lines, which are known to increase lead levels. The drop in levels observed during 1993-1996 for large water systems coincides with the time period in which most large water systems were not required to conduct lead and copper tap monitoring because they were conducting a CCT study and awaiting the state's decisions regarding the type of CCT to be installed (refer back to Exhibit I-3 for CCT step timeline). Medium and small water systems also have the highest percentages of lead action level

exceedances during the first year of monitoring, with the sharpest decline occurring in the two years following initial monitoring. This decline may be attributed to the initiation of CCT steps that do not require tap monitoring by water systems that exceeded the action level, more complete reporting of early monitoring results based on public interest in the rule, and a better understanding of proper sample collection procedures (e.g., instructing consumers to not collect samples after extended periods of non-use).

Exhibit III-2B. Percent of PWSs by Size Category with Copper Action Level Exceedances during 1992-2008 based on SDWIS/Fed Data



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.
Notes: See Exhibit III-2A.

Exhibit III-2B displays a similar decline in copper 90th percentile levels, with the largest percentage of exceedances occurring during the first year of monitoring for all system sizes. A slightly higher percentage of large water systems exceeded the copper action level in 1992 (about 5% compared to ~ 4.5% for medium and just under 4% for small systems). After 1992, the percentage of large

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water systems with copper action level exceedances dropped below that for medium and small water systems. Overall the percentage of systems that initially exceeded the copper action level is lower than those exceeding the lead action level (~17% of large, 8% of medium, and 5% of small exceeded the lead action level). This could be attributed in part to the tiering criteria, which is focused on lead-containing materials (i.e., lead solder prior to the lead ban, sites served by lead service lines). Despite such differences, the overall pattern for copper is very similar to lead.

It is important to note that some systems were in violation of their lead and copper tap monitoring and reporting (M/R) requirements (see Exhibit III-5). If systems had conducted the required monitoring, the percent that exceeded the lead action level would most likely be higher. Thus, these estimates presented in Exhibits III-2A and III-2B should be considered as lower bounds. In addition, some of the peaks and valleys in Exhibits III-2A and III-2B from the mid-1990s for systems serving 50,000 or fewer people and after 2001 for large systems may be attributable to the year in which the 90th percentile result was assigned.[7] For systems on triennial monitoring, EPA assumed that samples were collected during the last year of the three-year monitoring period. In addition, some of the slight increase in the lead and copper action level exceedances during 2004 and 2007 for medium and small water systems) may be due in part to EPA's efforts to improve state reporting of 90th percentile data to SDWIS/Fed.

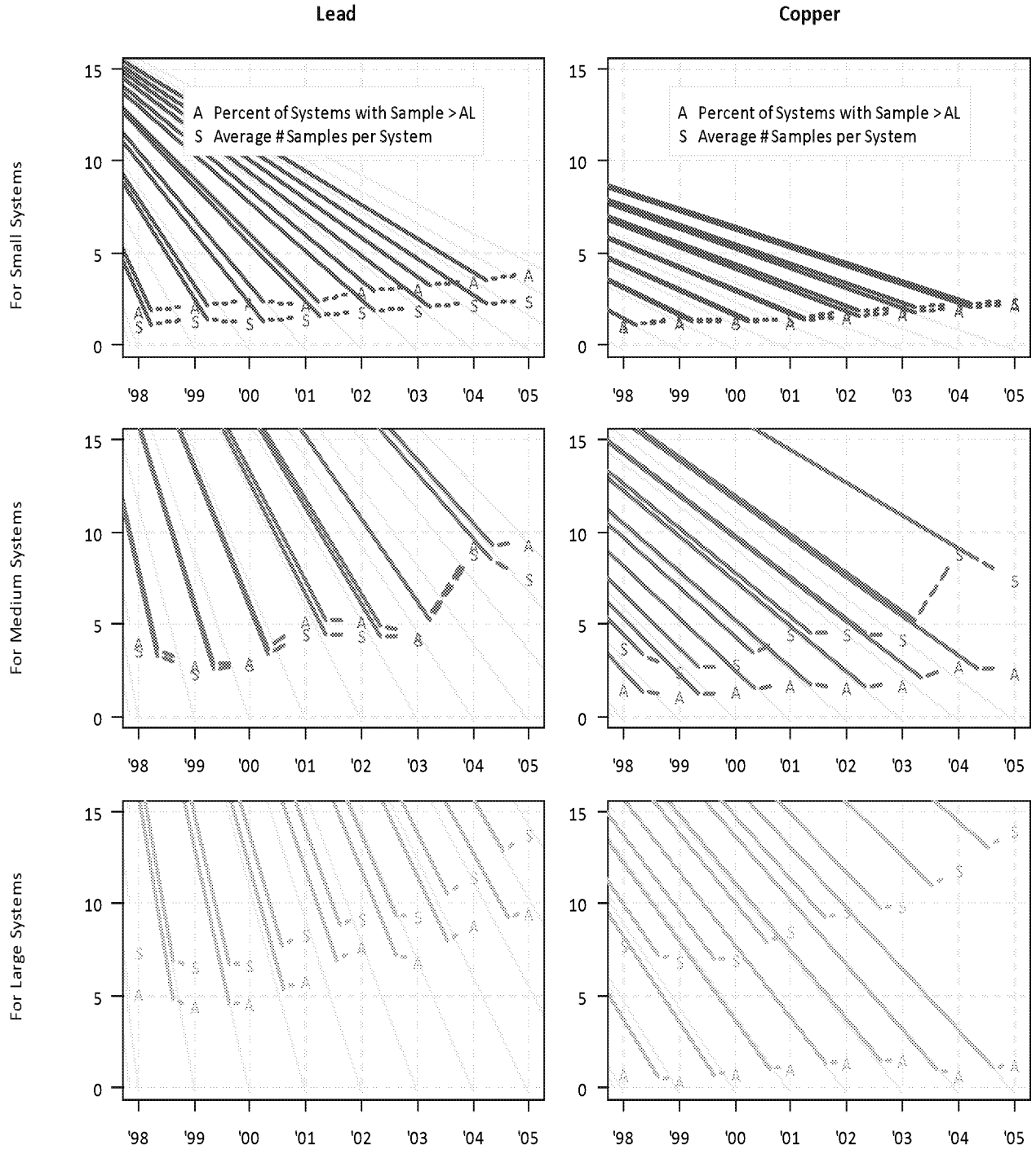
Lead and Copper Levels in Individual Sample Results above the Action Level

Exhibit III-3 plots the percent of systems with one or more samples above the lead or copper action level and the average number of samples reported per system for each year during 1998-2005 for the three LCR size categories based on the Six-Year Review-ICR dataset.

In this data, the percent of systems with one or more sample exceeding the lead or copper action level rose over time. This increase can be attributed to the number of samples reported each year because the probability of a water system having at least one exceedance increases with the number of samples reported. As shown by the average samples per system per year, the amount of sampling data voluntarily reported by states also increased in later years. (Also, refer to Exhibits III-4a through III-4c, which helps illustrate the underreporting of lead sample results in the Six-Year Review ICR data set.)

[7] Assuming that the water systems conducted the required monitoring on time and did not exceed either action level, medium water systems would qualify for triennial monitoring after 1995 and small water systems after 1996. Large water systems that install CCT according to the schedule in Exhibit I-3 and met their OWQPs would qualify for triennial monitoring after 2001.

Exhibit III-3. Percent of Systems with One or More Samples above the Action Level and Average Annual Number of Samples in Six-Year Review-ICR Dataset for 1998-2005



Source: Six-Year Review-ICR Dataset (1998-2005) for 43 states and tribal water systems in EPA Regions 8 and 9.

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Correlation between SDWIS/Fed and Six-Year Review Lead Data

Exhibits III-4a through III-4c shows the correlation between the two data sets that were used for EPA's analysis. Specifically, for each of the three LCR size categories, they indicate how few SDWIS/Fed 90th lead records have corresponding records in the Six-Year Review lead data. To construct these exhibits, EPA considered only those SDWIS Lead 90th percentile records from states that submitted Six-Year Review data and with begin and end dates for the monitoring period that were within the 1998-2005 range. For each remaining SDWIS/Fed lead 90th percentile record, EPA identified matching Six-Year Review records (i.e., had the same system PWSID and a sample collection date that falls within the SDWIS/Fed Lead 90th percentile monitoring period begin and end date). These exhibits show the count of SDWIS/Fed 90th percentile records with matching Six-Year records, broken out by the number of Six-Year records that correspond to each SDWIS/Fed record 90th percentile record. For example, in Exhibit III-4a, the left-most bar indicates that approximately 1,600 SDWIS lead 90th percentile records had no matching Six Year data. The bar labeled 30 shows that 250 SDWIS lead 90th percentile records each had approximately 30 corresponding records in the Six-Year database.

Exhibit III-4a. Number of Corresponding SDWIS and Six-Year Review Lead Records for 1998-2005 for Large Water Systems

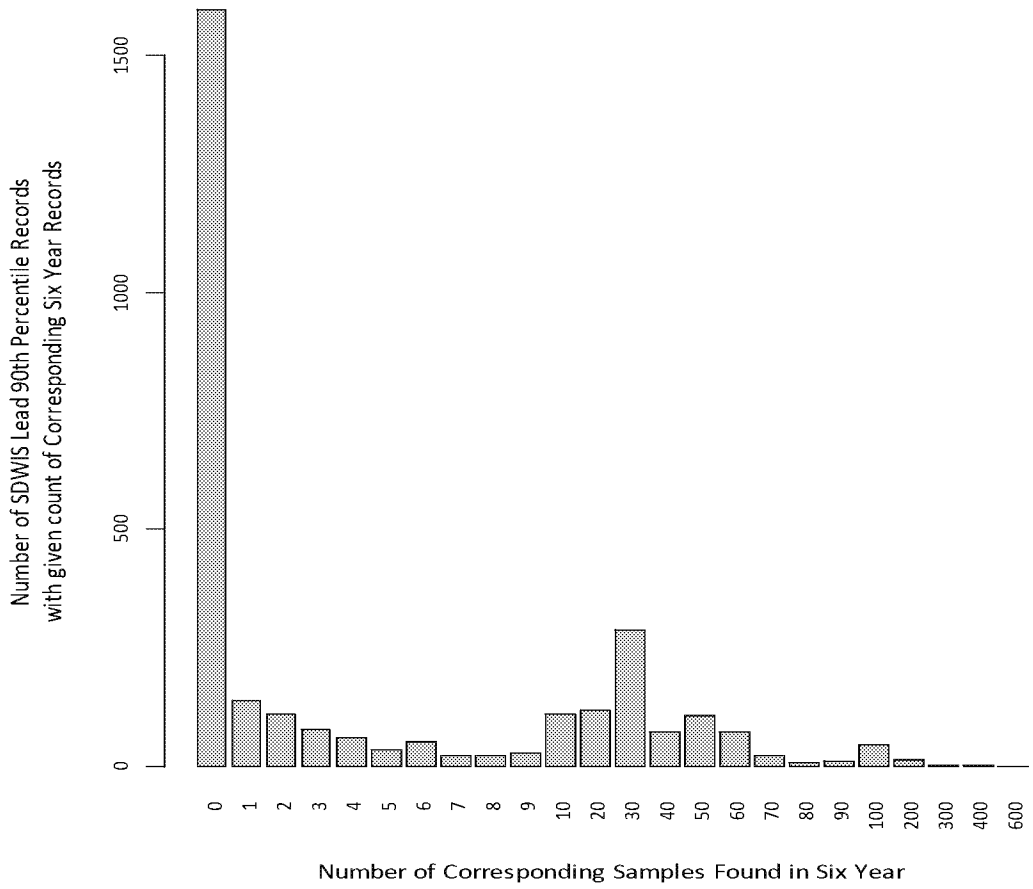


Exhibit III-4b. Number of Corresponding SDWIS and Six-Year Review Lead Records 1998-2005 for Medium Water Systems

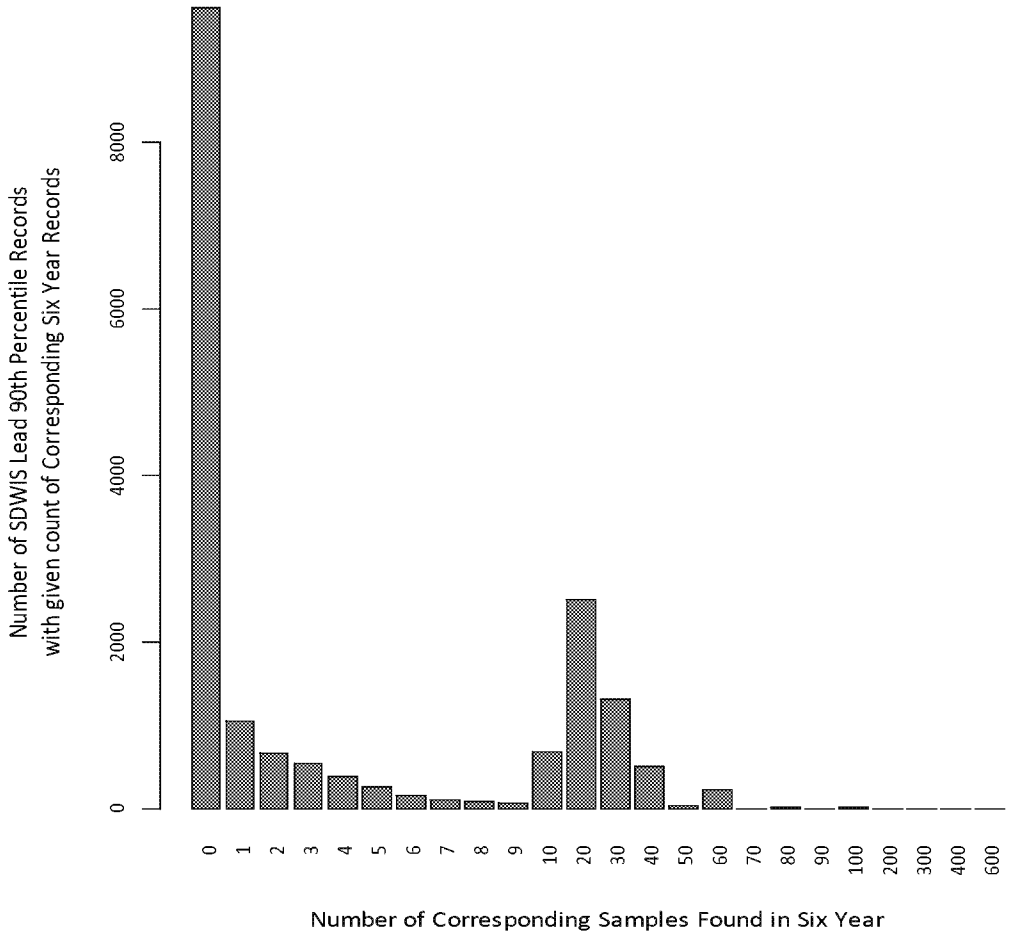
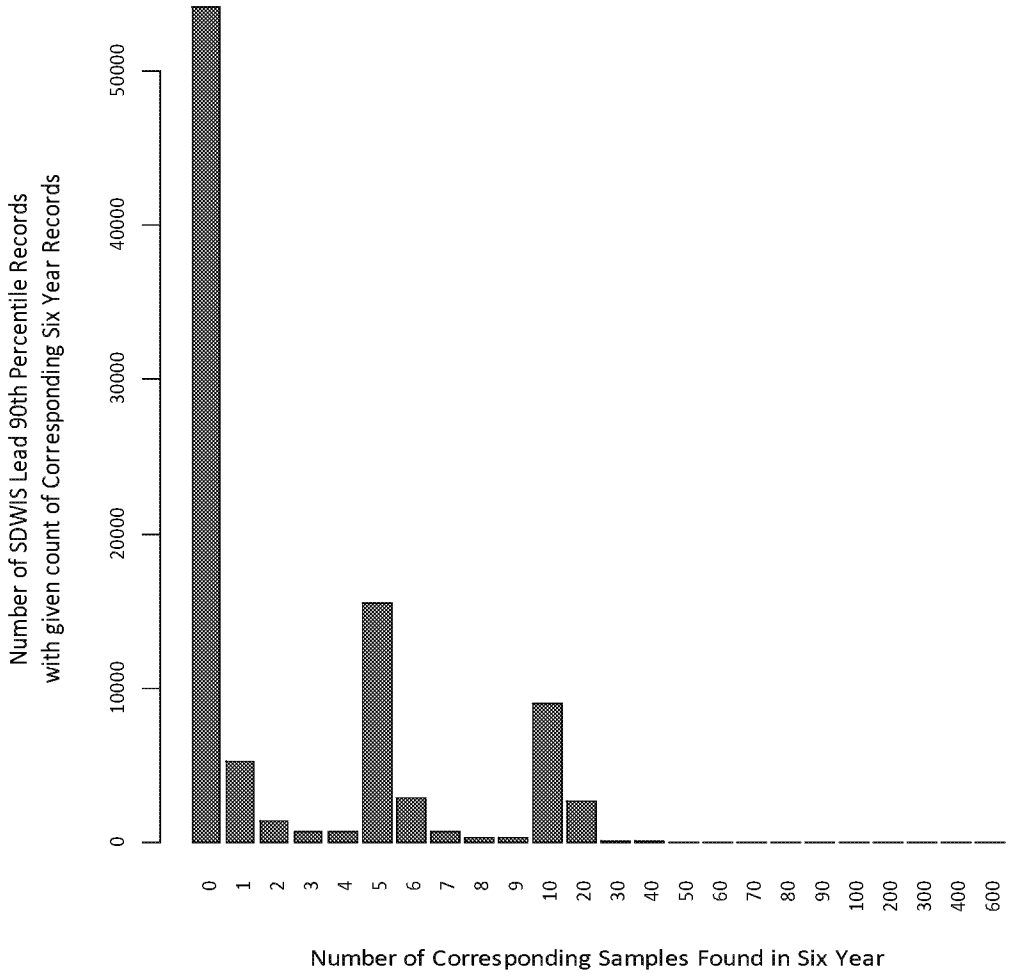


Exhibit III-4c. Number of Corresponding SDWIS and Six-Year Review Lead Records 1998-2005 for Small Water Systems



Exhibits III-4a through III-4c indicate that the majority of 90th percentile lead records reported in SDWIS/Fed do not have corresponding Six-Year Review sample results (approximately 1,600 records for large systems, approximately 9,800 for medium systems, and approximately 54,000 for small systems). In many instances, fewer than the minimum number of required samples were

collected and/or reported (see Exhibit III-4d).[8] Thus, the percentage of systems with samples above the lead (or copper action level) is most likely underrepresented in Exhibit III-3.[9]

Exhibit III.4d: Minimum Number of Required Tap Samples by Size		
System size *(population served)*	Standard Monitoring	Reduced Monitoring
	Number of sites	Number of sites
>100,000	100	50
10,001 to 100,000	60	30
3,301 to 10,000	40	20
501 to 3,300	20	10
101 to 500	10	5
≤100	5	5

Lead and Copper Tap Monitoring and Reporting Violations

The diagram below indicates the percent of small, medium, and large PWSs with one or more tap M/R violations for each year during 1992-2008, as reported to SDWIS/Fed. The percent was derived by dividing the number of systems with violations by the number of CWSs and NTNCWSs in that size category in the June 30, 2008 SDWIS/Fed inventory. For violations, the compliance period begin and end dates are reported to SDWIS/Fed in lieu of the monitoring period begin and end dates. Prior to the 2000 LCR Revisions, the compliance period was the same as the monitoring period. In response to these revisions, the definition for the compliance period begin date was revised to the day after the end of the monitoring period.[10] For example, a water system that was required to monitor during January 1, 2002 through December 31, 2004, and failed to so do, has a compliance period begin date of January 1, 2005. The compliance period end date is defaulted to December 31, 2025. When the system returns to compliance, this end date is replaced with the date the system returns to compliance. This change was made to facilitate tracking the length of time a system is out of compliance.

[8] In Exhibit III-4a, relatively taller bars at 30, 50, 60, and 100 reflect the minimum number of required tap samples for large water systems based on their population served and monitoring schedule (standard or reduced). In Exhibit III-4b, relatively taller bars at 20, 30, 40 and 60 reflect the minimum number of required samples for medium systems based on their population served and monitoring schedule. In Exhibit III-4c, relatively taller bars at 5, 10, and 20 represent the minimum number of required samples for small water systems based on their population served and monitoring schedule. Across all three size categories, systems sometimes take more samples than the minimum number required.

[9] Exhibits III-4a through 4c include only those results that passed EPA's quality assurance review (see Appendix B). Thus, more results were voluntarily provided by the state than plotted in these diagrams. However, in most instances, an incomplete set of sampling results was provided.

[10] In other words, the violation begins immediately after the period during which a PWS was supposed to complete a particular action but failed to do so.

To allow for a more meaningful comparison of how violation rates may have impacted the reporting of 90th percentile levels or lead and copper sample results, violations were assigned within the monitoring period for purposes of this analysis. For PWSs on triennial monitoring, the violation year is the beginning of the three-year monitoring period. In the example above, a water system that was required to monitor during January 1, 2002 through December 31, 2004, and failed to so do, was assigned a violation date of 2002. PWSs on semi-annual monitoring with more than one violation in the same year were counted once.

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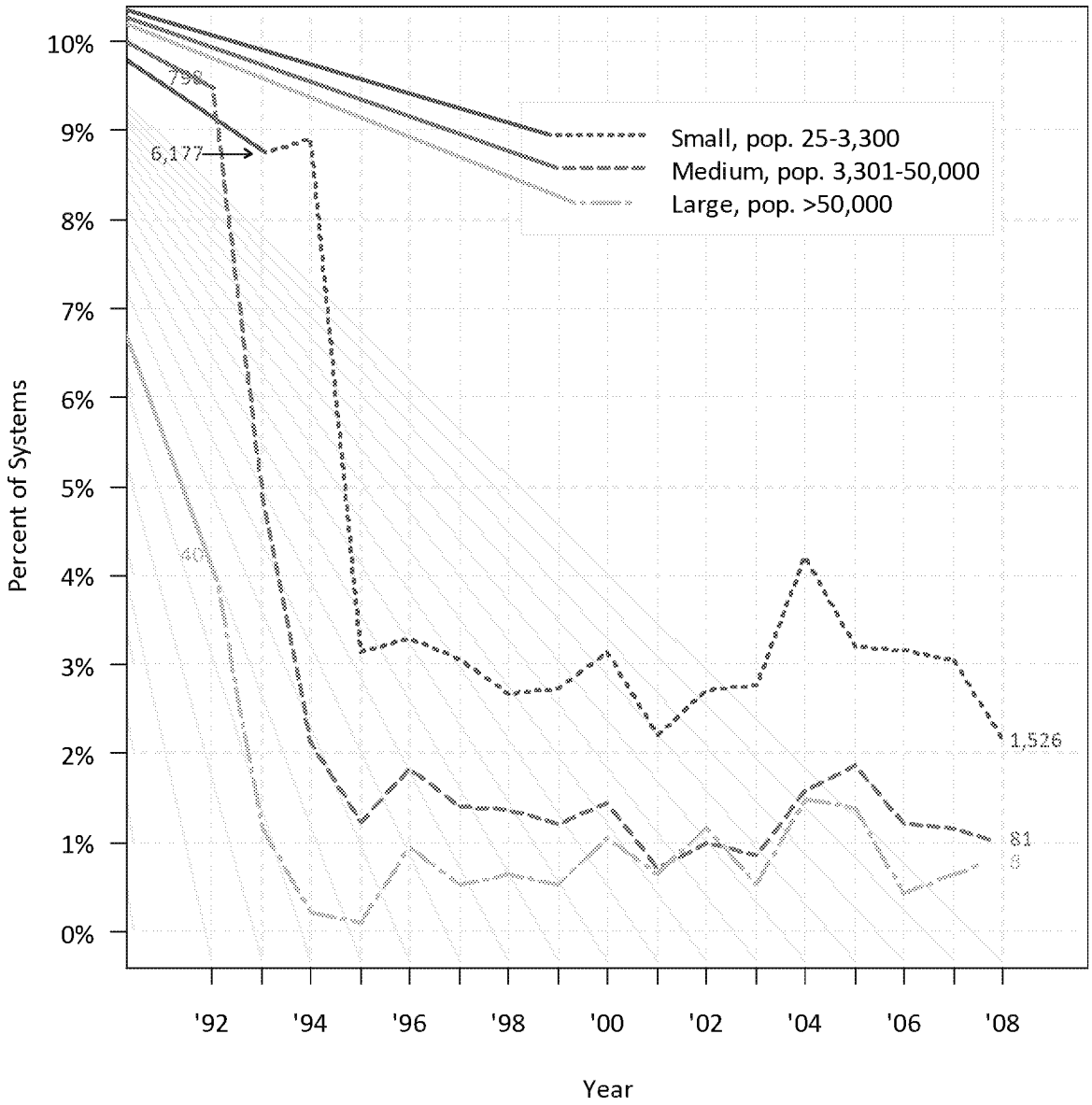
Exhibit III-5. Percent and Number of PWSs by Size Category with Monitoring Violations during 1992-2008 based on SDWIS/Fed Data



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.

Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data, PWSs in Ohio's inventory, and those violations with a compliance period end date prior to 1992 or after 2008.

2. Small water systems were not required to begin monitoring until 1993.

3. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

The highest percentage of violations occurred during initial monitoring, which is to be expected with the implementation of a new regulation. The percent of all violations rose slightly in 2004. This increase may be due in part to the year in which the violation was assigned for systems on triennial monitoring (i.e., during the first year of the three-year monitoring period) and to EPA's efforts in 2004 to improve state reporting of 90th percentile data to SDWIS/Fed.

Because the constructed violation percentage includes all water systems in a given size category in the denominator, even through systems on triennial and nine-year monitoring schedules are not required to perform monitoring every year, the frequency of violations may be understated by a factor between 2 and 3. Unfortunately, the various monitoring schedules for each PWS are not available in SDWIS/Fed and hence this more accurate calculation cannot be performed.

Corrosion Control Treatment Trends

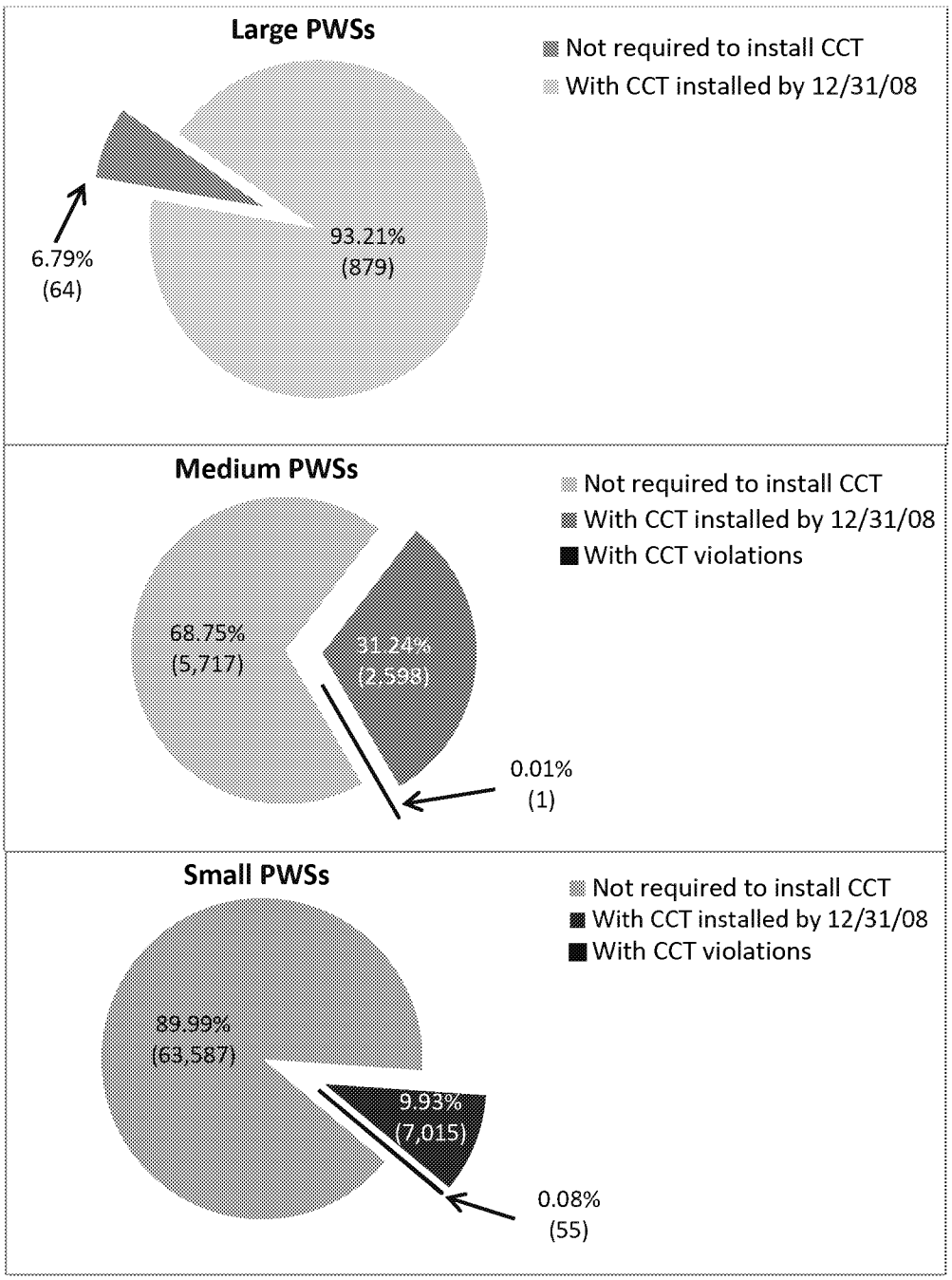
A. Universe of Systems Installing CCT

Exhibit III-6 indicates the percentage of systems by LCR size categories that belong to three different CCT categories: those that installed CCT by December 31, 2008; those that were not required to install CCT; and those had unresolved CCT installation violations as of June 30, 2009. A system was counted as not required to install CCT if it had none of the following: an unresolved CCT violation[11], a treatment code of "C", or a reason code of WQP for a DEEM or DONE milestone.

As discussed in Section I - Background, large water systems are required to install CCT regardless of whether their 90th percentile lead or copper value exceeds their action level with the exception of those that qualify as "b3" systems. Small and medium systems that continue to exceed one or both action level are required to install CCT. Approximately 90% of small water systems and 69% of medium water systems are not required to install CCT compared to approximately 7% of large systems. Less than 1% of small and medium water systems and no large water systems have unresolved CCT violations.

[11] Water systems were also counted in the category of not required to install CCT if they corrected their CCT violation in January to June 2009 and did not have a treatment code of "C" or a Deem or Done milestone with a reason code of WQP. The rationale for this decision was twofold: 1) 2009 is outside the time period of EPA's analysis; and 2) a medium or small water system could resolve its CCT violation by no longer being subject to the CCT requirements (at or below both action levels for two consecutive six-month monitoring periods).

Exhibit III-6. Comparison of the Number and Percent of Water Systems that Have or Are Required to Install CCT



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.

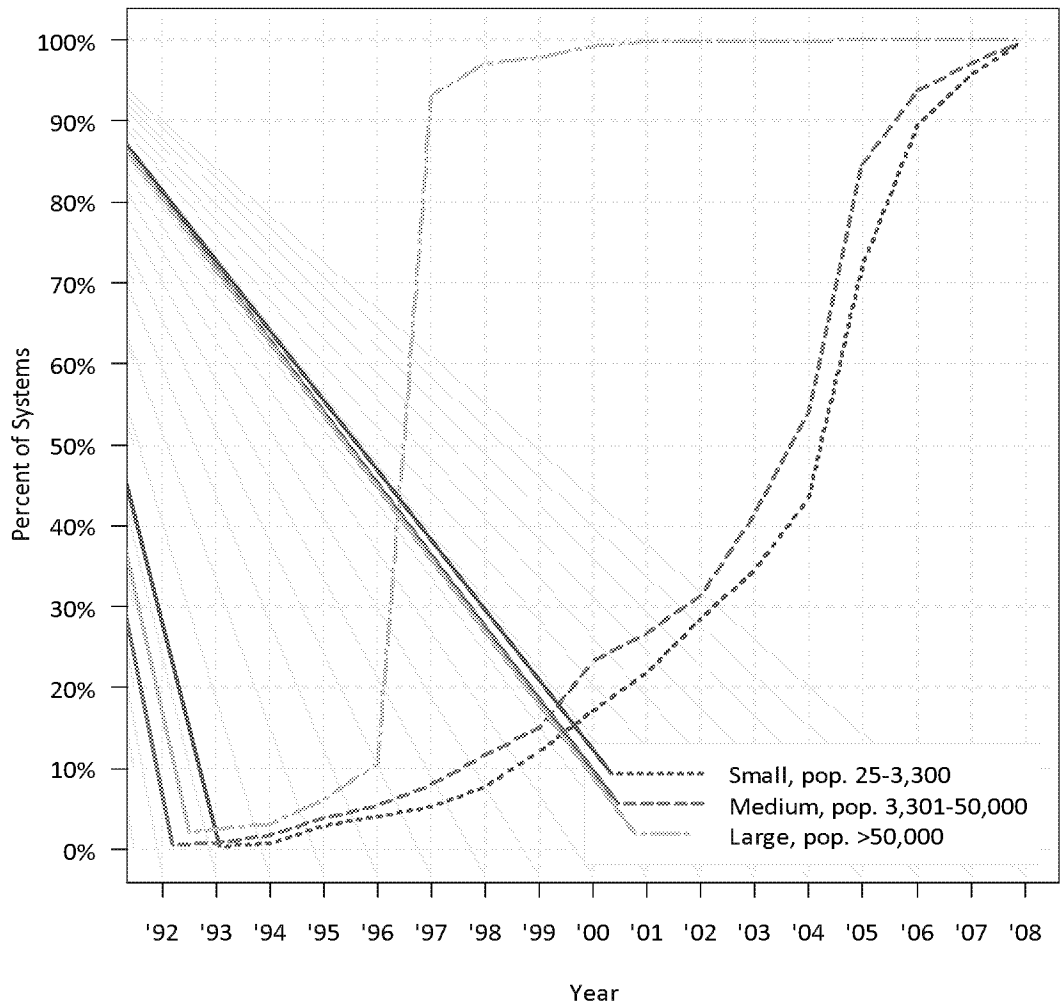
Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data, PWSs in Ohio's inventory, and those violations with a compliance period end date prior to 1992 or after 2008.

2. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

B. Timeline for Installing Treatment

Exhibit III-7 illustrates the year in which small, medium, and large water systems installed CCT (i.e., the step in the CCT process that occurs prior to the collection of follow-up monitoring and the state's designation of OWQPs). The exhibit does not include water systems that were not required to install CCT, have not installed this treatment by 2008, or which have outstanding CCT violations (see Exhibit III-6 for CCT violation percentages). Also, refer to Appendix A for a discussion of how the CCT dates where determined.

Exhibit III-7. Timeline for Installation of CCT by System Size for 1992-2008 based on SDWIS/Fed Data



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.

Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data, PWSs in Ohio's inventory, and those violations with a compliance period end date prior to 1992 or after 2008.

2. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

The graph indicates that the majority of large water systems installed CCT during or before 1997, with approximately 2% installing the treatment prior to 1992. As previously discussed in the Section I - Background, large water systems were required to install CCT by January 1, 1997. As described in Appendix A, large water systems were assumed to install CCT on January 1, 1997 unless violation, milestone, and/or treatment information had been reported to SDWIS/Fed that indicated that this CCT had been installed during a different year.

For medium and small water systems, the LCR does not specify an exact date for CCT installation but outlines the timeframe for water systems and states to complete specific CCT steps, as well as the criterion for discontinuing and recommencing these steps. Approximately half of the medium and small water systems that had installed CCT did so by 2004, with this number jumping to 80% in 2005 for medium systems and 2006 for small systems.

C. Impact of CCT on Lead 90th Percentile Levels for Large Systems

Exhibit III-8 below shows the estimated effect of CCT on 90th percentile lead levels for all large water systems including those with and without CCT. This exhibit is limited to large water systems because they were the only size category for which both exceedances and non-exceedance lead levels were consistently reported (because they were requested prior to 2000 and required thereafter).[12] Thus, a comparable exhibit cannot be provided for copper because only those 90th percentile copper levels that exceed the action level are required to be reported to SDWIS/State for all system sizes.

The three plotted lines demonstrate the following:

- Lower quartile – indicates the level below which 25 percent of all large systems' 90th percentile levels fall for a given year. For example, in 1992, 25% of all large system's 90th percentile lead levels were 4 µg/l or less. In 1994, 25% of these values were ~2.5 µg/L or less.

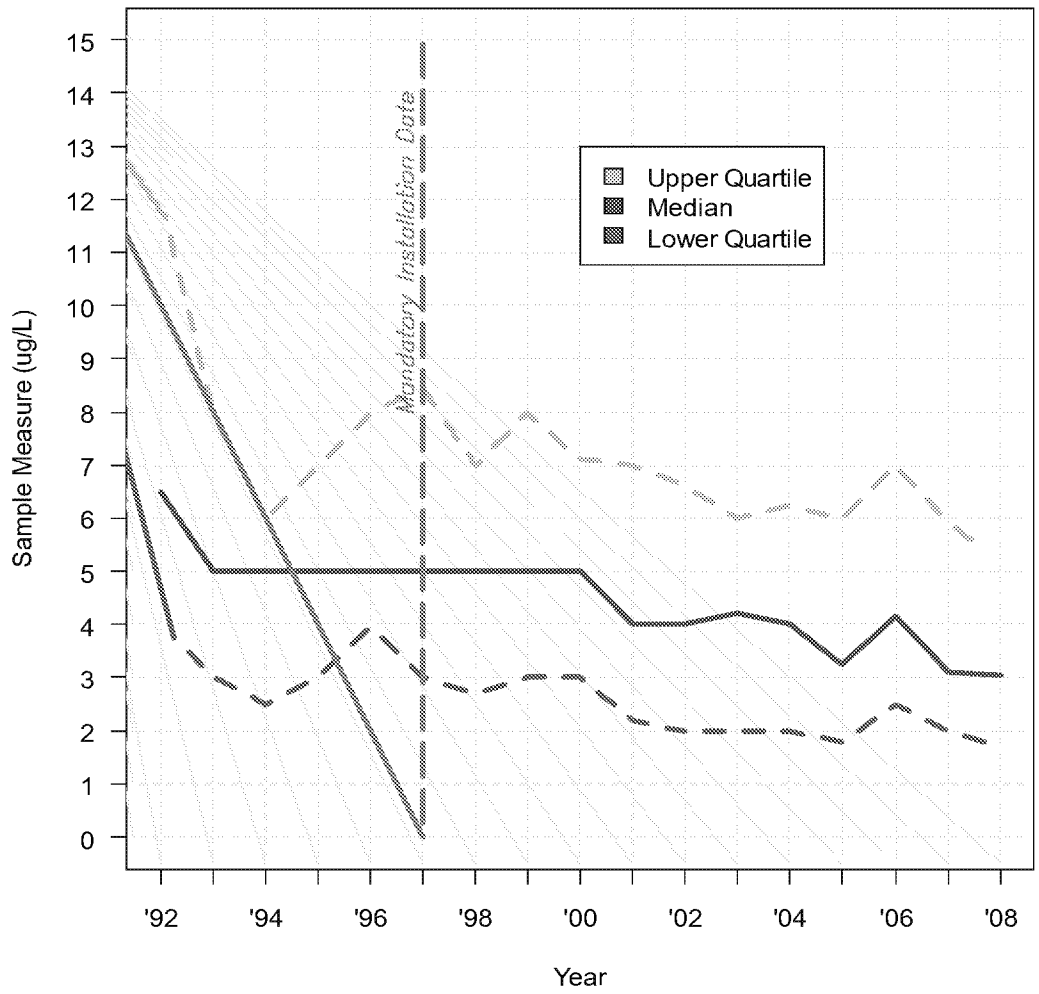
- Median – indicates the midpoint for all 90th percentile lead levels below which 50% of all large systems' 90th percentile levels fall.

[12] As explained in Section I, prior to 2000 LCR Revisions, EPA requested that states report 90th percentile non-exceedances for lead to SDWIS/Fed for all large systems, and for medium and small systems once they exceeded the lead action level. With the 2000 LCR Revisions, states are required to report SDWIS/Fed any 90th percentile values that exceed the lead or copper action level and those 90th percentile lead levels that are at or below the action level (i.e., non-exceedances) for water systems serving more than 3,300 people. Neither the original rule nor 2000 Revisions require states to report copper 90th percentile non-exceedances for any water system or 90th percentile lead non-exceedances for small water systems.

- Upper quartile – indicates the level below which 75 percent of all large systems' 90th percentile levels fall for a given year. For example, in 1992, 25% of all 90th percentile lead levels were 12 µg/l or less.

If a system reported multiple values in a given year, then the system's level for that year was represented by the median of the values it reported that year. The diagram also indicates the rule mandated date by which water systems must install treatment. As shown in Exhibit III-8, approximately 95% of large water systems that installed CCT were estimated to install this treatment by the mandatory date of 1997 (refer to discussion in previous section regarding the use of 1997 as a default date). However, a small percentage installed significantly before or after 1997 or outside the 1992-2008 analysis window entirely. The exhibit shows an overall decline in lead 90th percentile levels in large systems.

Exhibit III-8. Upper and Lower Quartile, and Median Lead 90th Percentile Levels for Large Water Systems



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009, and exclusive of Ohio's data.
Notes: Graph includes CWSs and NTNCWs regardless of CCT installation date.

D. Modeled Effect of CCT on Lead and Copper 90th Percentile Levels and Sample Results

Exhibit III-9 displays the results of a parametric statistical model that EPA used to estimate the percent change in lead and copper levels as a result of CCT installation (see Appendix C for a description of the model). The model accounts for the censoring of data by detection limits and reporting requirements.[13] It also accounts for the fact that different systems have different long-term means and that lead and copper concentrations may drift downward or upward during the reporting period regardless of whether the system has installed CCT. If a system installed CCT before 1992, then all of its observations were considered to be post-CCT.

The model's parameters were fitted using maximum likelihood estimation, with a separate parameter search conducted for each of 12 different subsets of data – one model for each combination of contaminant (lead or copper), dataset (SDWIS or Six-Year), and system size (small, medium, or large) (2*2*3=12). For each data subset, the plot indicates the central estimate of the effect of CCT with a short black horizontal bar. The estimate is surrounded by a colored box, which bounds the model's 50% confidence interval for the statistic. The whiskers extend to cover the 95% confidence interval. The 50% confidence interval and the 95% confidence interval are measures of uncertainty.

Based on the SDWIS/Fed data, the model results show that CCT resulted in a drop in lead 90th percentile levels, ranging from just below 10% for large systems to more than 30% for small systems. The model results also show that CCT resulted in a drop in copper levels, ranging from 10% for medium systems to over 40% for large systems. In contrast, the model results using Six-Year Review-ICR data is mixed. For the most part, CCT was found to lower lead and copper levels; but there are two notable exceptions: lead levels for medium systems and copper levels for small systems. Most likely, these aberrations are due a sample selection effect in the data that got reported for the Six-Year review.[14]

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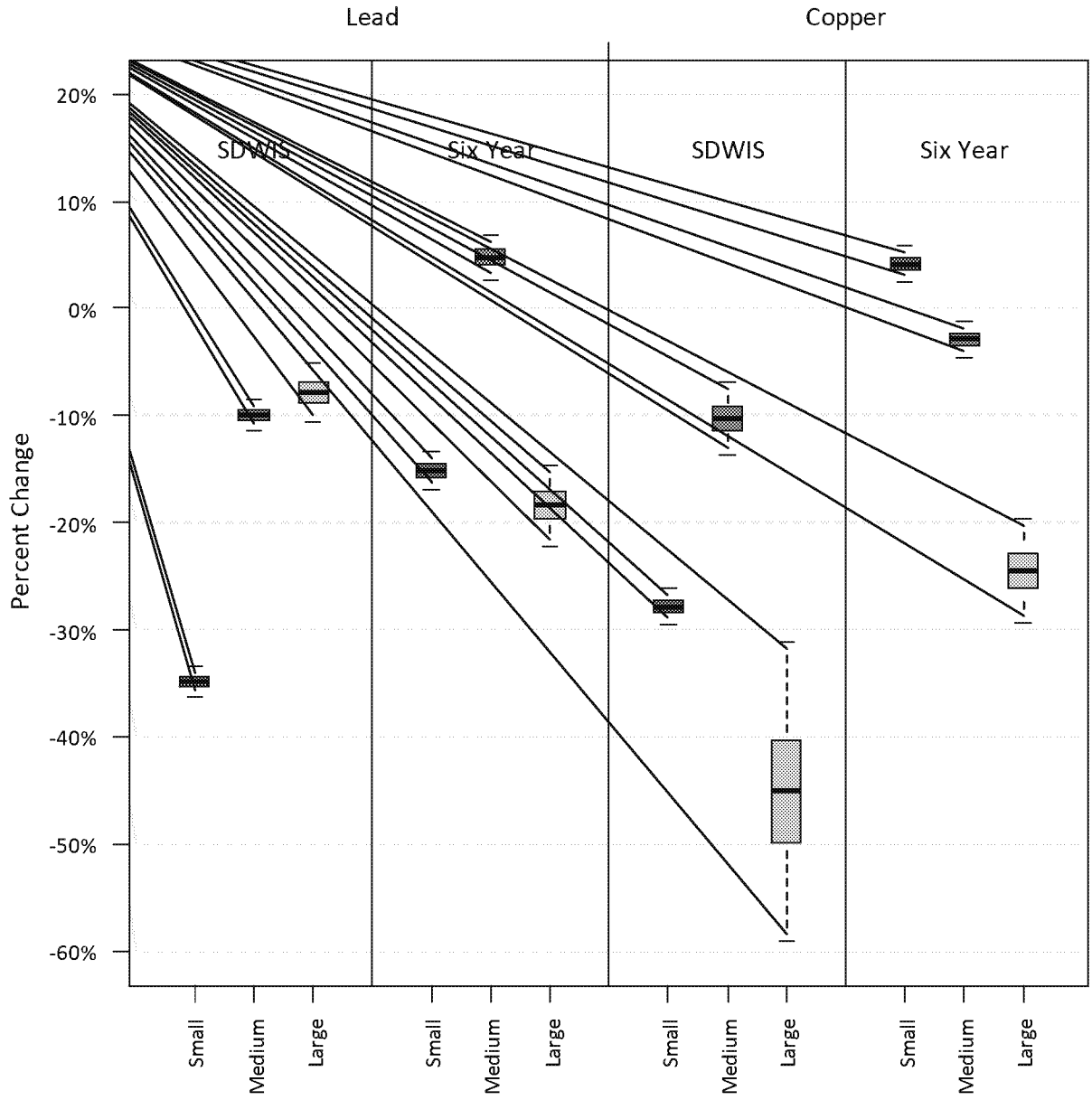
[13] Censoring occurs when the true value of a data point, the concentration of lead or copper in this case, is unobserved by the analyst, who only knows that the level fell within a range. For instance, if the concentration was below the detection limit, then the analyst does not observe the actual concentration but rather observes the minimum detectable limit.

[14] A sample selection effect occurs when the observations appearing in the sample are not representative of the population. In this context, systems with lower concentrations are over-represented in the earlier years compared to later years when more data were reported. In that case it would appear (erroneously) that levels had risen over time due to CCT, rather than the actual reason for the increase, which is due to changes over time in the composition of number and size category of systems conducting the monitoring).

Exhibit III-9. Modeled Effect of CCT on Lead and Copper Levels based on SDWIS/Fed and Six-Year Review-ICR Dataset

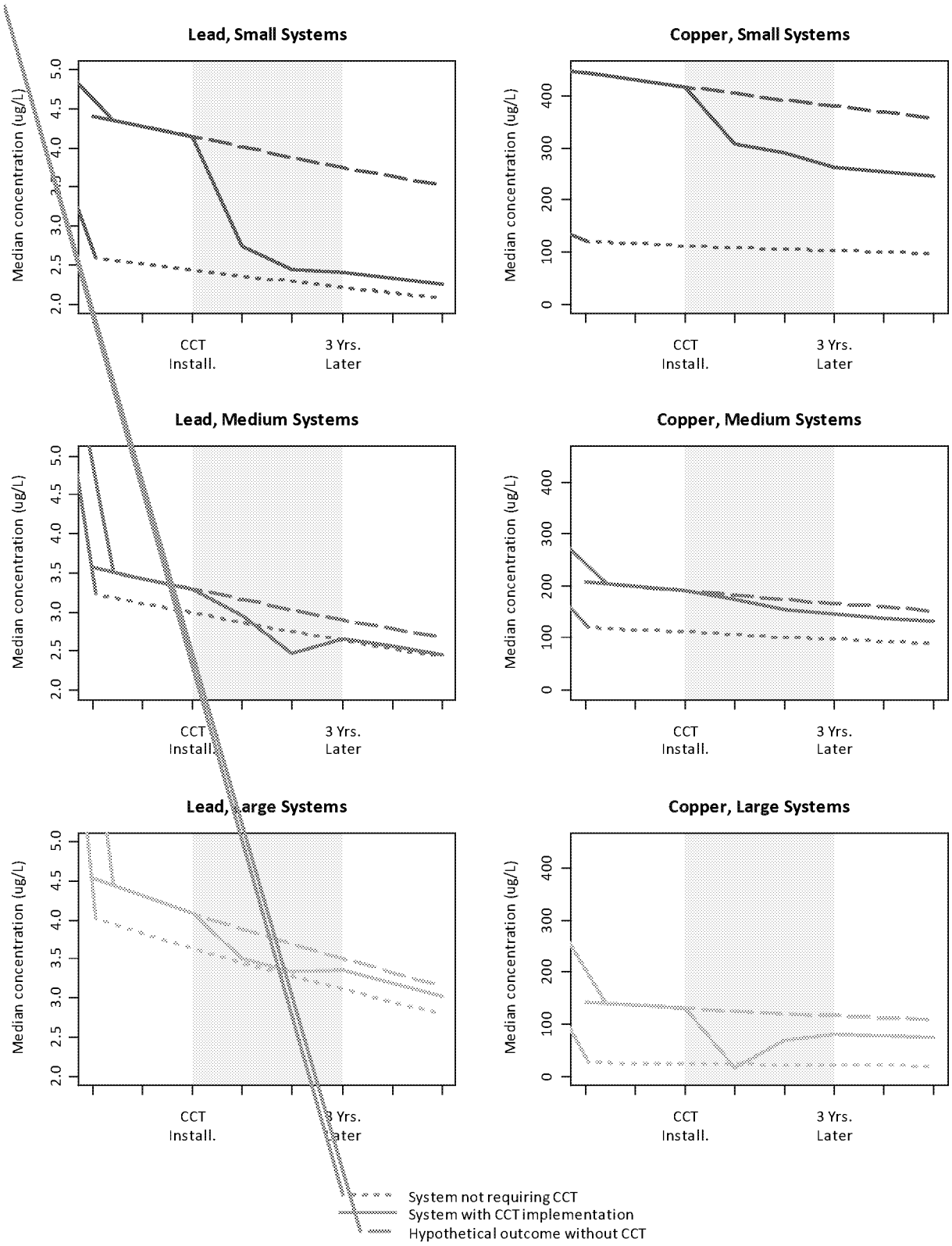


The model results presented in Exhibit III-9 assume that installing CCT produces an immediate and permanent effect on lead and copper concentrations. To explore a lagged effect of CCT, EPA estimated the effect of CCT on lead and copper levels for the first year since CCT installation, the second year since CCT installation, and the third year since CCT installation (and beyond). Exhibit III-10 displays the modeled results for SDWIS when the effect of CCT is delayed. The dotted line traces out the time path of the median lead and copper 90th percentile levels for a system that never implements CCT; such systems identify the autonomous trends in lead and copper levels that, if ignored, could confound findings on the effects of CCT on concentrations. The solid line traces out the median observed lead and copper 90th percentile levels over a system implementing CCT. The shaded region indicates the period of time that corresponds to one year, two years, and three years following CCT installation. The left border of this shaded region is the time when CCT is implemented and the right border is the time when the delayed effects of CCT have stabilized out to their permanent levels. The dashed line represents the counterfactual – what the time path of concentration would have been had CCT never been installed – it departs from the solid line at the point in time when CCT is installed. Hence, the effect of CCT is the difference between the solid line and the dashed line.

The rate of decline in median lead 90th percentile levels for systems without CCT is similar across all system size categories. The same pattern holds true for median 90th percentile copper levels. For systems with CCT, the model showed a statistically significant decline in median 90th percentile level as a result of CCT, across system size categories for both lead and copper. The magnitude of the decline ranged from just below 10% for median copper 90th percentile levels for medium systems to more than 40% for median lead 90th percentile levels for small water systems. However, for medium and large systems, there appears to be an overshooting effect: CCT initially produces a dramatic drop within the first year or two following CCT installation but then rebounds to a higher level that is still lower than the counterfactual level. Rather than indicating an actual rebound in lead and copper levels, these trends could reflect systems switching to reduced monitoring. The minimum number of required samples for systems serving 101 or more people that are on reduced monitoring is half of the required number for those on standard monitoring. In some instances, States may have required water systems on reduced monitoring to use sampling sites that historically yielded higher lead results to help ensure the continued optimization of corrosion control.

It is noteworthy that large systems have the lowest median copper 90th percentile levels and small systems have significantly higher median copper 90th percentile levels, while this same relationship between system size and concentration does not hold for lead. The reason for this pattern is unknown.

Exhibit III-10. Modeled Effect over Time of CCT Operations on Median Lead and Copper 90th Percentile Levels for each Size Category



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Conclusions

Based on its review of lead and copper 90th percentile values, milestone, violation, and treatment data reported to SDWIS/Fed (1992-2008) and lead and copper sample results voluntary reported to EPA as part of the Six-Year Review process (1998-2005), EPA observed an overall decline in lead and copper levels during 1992 through 2008. EPA conducted modeling to assess whether this decline could be attributed to CCT and whether the length of time that CCT had been in place influenced the observed lead and copper levels.

Approximately 10% of small water systems and 30 % of medium water systems are required to install CCT compared to about 93% of large systems water systems that are required to install CCT. Less than 1% of small and medium water systems and no large water systems have unresolved CCT violations.

The largest percentage of lead and copper action level exceedances occurred during the first year of monitoring for all system sizes. A greater percentage of large water systems exceeded the lead (17%) and copper (5%) action levels during initial monitoring than medium (8% for lead; 4.5% for copper) or small water systems (5% for lead; just under 4% for copper). The higher percentages observed for the large water systems may be attributed to better reporting for these water systems, which may be partly in response to an EPA press release that identified large water systems that had exceeded the lead action level based on their initial 1992 monitoring data. The fact that a lower percentage of systems (overall) exceeded the copper action level than the lead action level, during initial monitoring, may be due in part to the current tiering criteria, which targets the sampling locations that are expected to yield the highest lead results.

Based on its analysis, EPA concluded that some of the decreases in these levels occur in systems without CCT. Possible reasons for this autonomous decline may include the aging of lead- and copper-bearing plumbing materials, which release lower levels of lead and copper; replacement of residential leaded plumbing materials by homeowners; replacement of lead mains and service lines by water systems during routine replacement and maintenance; and changes in monitoring locations due to homeowners dropping out of the sampling program.

To separate out this autonomously declining trend in lead and copper levels, as well as to handle a variety of data quality limitations (particularly censoring), EPA built a statistical model of lead and copper concentrations as a function of the installation date of CCT. Across system size categories for both lead and copper, the model results consistently showed a statistically significant decline in the median 90th percentile level as a result of CCT. The magnitude of the decline ranged from just below 10% for median copper 90th percentile levels for medium systems to more than 40% for median lead 90th percentile levels for small water systems.

When the model was adapted to allow for delayed responses to CCT, the effects grew over time for small systems; in contrast, medium and large systems appear to exhibit an overshooting effect: CCT initially produces a dramatic drop within the first year or two following CCT installation but then rebounds to a higher level that is still lower than the counterfactual level.

Note that the accuracy of EPA's assessment is affected by data quality (e.g., reporting of incorrect units and dates) and completeness constraints in both the SDWIS/Fed and the Six-Year Review ICR data set. Information that is required to be reported to SDWIS/Fed (90th percentile exceedance data and lead non-exceedances data for larger water systems, and violation, milestone, and treatment information) is underreported. In addition, the lack of a milestone that corresponds directly to the date of CCT installation, changes to milestone reporting requirements and related guidance, and inconsistencies within and among states' interpretation and reporting of these milestones complicated EPA's determination of when CCT was installed.

EPA found that the Six-Year Review-ICR data set, which contains lead and copper sample results that were voluntarily submitted by states, had even greater data quality issues. The majority of 90th percentile lead and copper levels reported to SDWIS/Fed had no corresponding Six-Year Review lead or copper sample data, and in several instances, the number of lead and copper sample results was less than the minimum required number of samples. However, the completeness of the Six-Year Review information improved throughout the Six-Year Review period of 1998-2003 and may account for the rise in the number of lead and copper sample results that were above the action level.

Appendix A
Procedure for the Determining Date of Corrosion Control Treatment Installation

This appendix describes the information and approach that EPA used to approximate the date that corrosion control treatment (CCT) was installed. This date refers to the step that precedes follow-up monitoring and the designation of optimal water quality parameters (OWQPs) by the state. These steps are described in Exhibit I-3 in the main body of the report.

A. Information Used to Approximate CCT Installation Date

The date that a water system installed CCT is not explicitly reported to SDWIS/Fed. However, the following dates associated with three types of records that are reported to SDWIS/Fed can be used to help identify the date that CCT was installed.

- Date associated with the treatment code of "C" (C designates CCT).
- Date that a system returned to compliance with its CCT violation.
- Date associated with a Deem or Done milestone.

Each of these types of data and their limitations are described in more detail below.

Treatment Code

A treatment objective code of "C" indicates a water system that has installed CCT. The date associated with the treatment code of "C" indicates when the state reported the record to SDWIS/Fed but not necessarily when the treatment was installed by the water system. Thus, as described in Section B below, EPA used the earliest reported treatment date (if multiple "C" treatment records were reported) in combination with the date a system resolved its CCT violation (if applicable) or the date the state reported a Deem or Done milestone to estimate the CCT installation date.

Violations

A violation code of 58 is reported by the state for water systems that failed to meet their CCT requirements. This violation is defined as a system that fails to: have the State-designated treatment properly installed and operating in accordance with §141.82(e) of the LCR; submit a certification of proper installation and operation in accordance with §141.90(c)(4), or demonstrate

that OCCT already exists in accordance with §§141.81(b)(1)-(3) and 141.90(c)(1) (from Appendix B – LCRMR Reporting Guidance, October 2001).[15]

All violations have a compliance period begin and end date. According to the October 2001 LCRMR reporting guidance, the begin date of the violation is the day after the system failed to meet its CCT installation requirements. The end date (ComplPerEndDate) is defaulted to December 31, 2025. When a system returns to compliance, the 2025 date is replaced with a reported compliance period end date that marks the end of the violation.

For purposes of EPA's analysis, if the reported *ComplPerEndDate* of the CCT violation was greater than June 30, 2009 (the date the data were downloaded from SDWIS), the violation was considered to be unresolved and was used as an indicator that CCT may not have been installed. If there were multiple "resolved" CCT violations on record for the system, only the one with the earliest reported *ComplPerEndDate* was considered for determining the date of CCT installation.

Milestones

Deem and Done Milestone Description

Three milestones, Deem, Done, and LSLR are used to indicate the initiation or completion of key requirements of the LCR.[16] **"Deem"** represents the basis for the State's determination that a system is "deemed" to be optimized under the LCR. Three reason codes are to be reported with this milestone to explain how a system is deemed.

[15] A 58 violation is also used to identify water systems that are in violation with the source water treatment installation requirements. However, very few water systems have high lead and copper source water levels and are required to install source water treatment.

[16] The 2000 Revisions to the LCR revised the milestone reporting requirements (11 milestones were reduced to 2 new milestones of "Deem" and "Done", and one existing milestone that indicated systems required to begin lead service line replacement (milestone LSLR was retained)). The Done milestone replaced: OTIN – system installed CCT; STIN – system installed source water treatment; MPLS – state set maximum permissible levels (MPLs) for source water; OWQP – state set OWQPs.

Exhibit A-1: Milestone Reason Codes	
Reason Code	To Be Reported When:
B1	A PWS serves ≤ 50,000 and is at or below both action levels for 2 consecutive, 6-month monitoring periods (i.e., meets the criteria specified in §141.81(b)(1) of the LCR, also known as a B1 system).
WQP	• A PWS has installed CCT prior to the December 7, 1992 (i.e., meets the criteria specified in §141.81(b)(2) of the LCR, also known as a B2 system); or • The State has designated optimal water quality parameters (OWQPs) that define how CCT must be operated.
B3	A PWS that serves > 50,000 people and has minimal levels of corrosion in its distribution systems (i.e., meets the criteria specified in §141.81(b)(3) of the LCR, also known as a B3 system).
Note: A system can meet the B1 or B3 criteria without physically installing corrosion control treatment. Source: Based on EPA's October 2001 guidance, Appendix B - LCRMR Reporting Guidance.	

"Done" indicates when a water system has completed all required steps to reduce lead and/or copper levels, which include:

- The date the state designates OWQPs, or deems the system to have optimized corrosion control according to §141.81(b)(1) or (b)(3) [corresponds to reason codes B1 and B3, respectively];
- For systems triggered into source water treatment, the date the state designates maximum permissible source water levels or determines that source water treatment is not required; or
- For systems triggered into lead service line replacement, the date the system completes lead service line replacement or becomes eligible to cease lead service line replacement because the system is below the lead action level for two consecutive monitoring periods.

The Done milestone date to be reported corresponds to the latest event that the system was required to complete. Note that in the October 2001 Lead and Copper Rule Minor Revisions (LCRMR) reporting guidance, reason codes were not be reported with the Done milestone. However, the September 2007, Minimum Reporting Requirements for the Safe Drinking Water Information System (SDWIS/FED) indicates that these codes may be optionally reported for the Done milestone.

The following milestones indicate the systems that have installed CCT:

- Deem milestone with a reason code of WQP (hereafter referred to as Deem-WQP).
- Done milestone with a reason code of WQP (hereafter referred to as Done-WQP).

- Done milestone without a reason code (hereafter referred to as Done-no reason code) if a treatment code of "C" has also been reported and the Done milestone date does not correspond to the date reported for a Deem milestone with a reason code of B1 or B3.

The date that a system installed CCT can be approximated from the date that a Deem-WQP, Done-WQP, or Done-no reason code milestone is reported. A date of 1992 or earlier indicates that the system installed treatment prior to the rule. Thus, all sample results were collected after CCT. A date after 1992 indicates a water system that did not have CCT in place prior to the rule and should indicate the date that the state set OWQPs. As described in Exhibit I-3, after a water system installs CCT, it is required to conduct follow-up monitoring during two consecutive six-month monitoring periods. The state then has six months to set the OWQPs. Thus, the setting of OWQPs should occur approximately 18 months after the system installs CCT. The approximate date of CCT installation would be the Deem-WQP, Done-WQP, or Done-no reason code milestone date minus 18 months.

"LSLR" identifies those water systems that are required to replace lead service lines and the date replacement is to begin. This milestone was not used to estimate the date of CCT installation.

Factors that Complicate the Use of Deem and Done Milestone Dates

There are several factors that complicate using the Deem and Done milestones to identify the date of CCT installation as follows:

- Some states do not report milestones to SDWIS/Fed, report them sporadically, or report them incorrectly (e.g., incorrect date, use of reason code of B1 for large systems). See Exhibit A-2 for the number and type of milestone records that were reported to SDWIS/Fed.

- Reason codes have been reported for some Done milestones, in many other instances, Done is reported without a reason code. This may be due inconsistencies between the October 2001 Lead and Copper Rule Minor Revisions (LCRMR) reporting guidance and more current guidance (refer to the bullet below). Also see Exhibit A-2.

- The guidance issued since the October 2001 LCRMR reporting guidance has changed regarding the reporting requirements for the Done and Deem milestone. For example, the September 2007, Minimum Reporting Requirements for the Safe Drinking Water Information System (SDWIS/FED):

  - Indicate that the reason codes (see Exhibit A-1) can be optionally reported for the Done milestone. In the October 2001 guidance, reason codes were to be reported for the

Deem milestone only. Because these codes were developed to define the Deem milestone, they are not a "perfect fit" for reasons a system meets the Done milestone definition. Specifically, there are no reasons codes to indicate the installation of source water treatment or the fulfillment of lead service line replacement requirements. Note that the milestone of LSLR does not identify water systems that have completed the lead service line requirements but instead indicates when a water system is required to initiate LSL replacement.

- Redefines Deem as "System deemed optimized w/o OCCT [optimal corrosion control treatment]" and Done as "System done with OCCT. The revised Deem definition conflicts with the reason code of WQP, which is to be reported for water systems with CCT.

- Redefines the reason codes as "**B1** Serving fewer than 50,000; met action levels"; "**B3** Serving greater than 50,000; met action levels"; and "**WQP** Water Quality Parameters".

- More than one Done or Deem milestone can be reported because the status of a water system can change (e.g., the system no longer qualifies as a B1 or B3 system, or is no longer in compliance with its OWQPs).

- The same date should be reported for the Done and Deem milestone but instead the dates vary by a few days. For example, a water system serving 50,000 or fewer people was at or below both action levels for two consecutive six-month monitoring periods. This water system met the Deem-B1 criteria and also met the Done criteria because they were considered to be optimized. The dates for the two milestones should have been the same but instead, the state reported a Deem-B1 milestone on 12/31/1996 and a Done-no reason code milestone on 1/1/1997.

- For systems that met the Done or Deem criteria prior to the effective date of the 2000 Revisions of April 11, 2000, the state had the option of reporting April 11, 2000 in lieu of the actual date.

Exhibit A-2 indicates the number of milestone and reason codes that were reported to SDWIS/Fed.

Exhibit A-2. Milestone Reporting Tally		
Event	**Reason Code**	**Number of Systems**
DEEM Milestone[1]		
DEEM	B1	32381
DEEM	B3	198
DEEM	WQP	623[2]
DONE Milestone		
DONE	(None Reported)	9600
DONE	B1	13786
DONE	B3	137
DONE	WQP	389
LSLR[3]	N/A	76

[1] 40 States reported one or more Deem milestones *(Never reported by AL, CA, CO, DE, FL, HI, MS, MT, NC, NJ, NM, NV, UT, WA, WY).*

[2] DEEM-WQP was reported by 14 states/entities: EPA Region 5, ID, IL, IN, MA, MD, MI, MN, OH, PA, TN, VA, VT, WI. 55 of the 623 systems reporting DEEM-WQP list their EventActualDate as 4/11/2000. Of those, 52 are from IL, and 3 are from VA.

[3]Reported by DC, IA, IL, MA, MI, MN, MT, OH, PA, RI, VA, WI.

In response to these data considerations, EPA made the following decisions related to the use of milestone data (also refer to Section B below):

- If both a Deem-WQP and Done-WQP milestone are reported and the dates are different, the Deem-WQP milestone date is used to estimate the CCT date. The rationale for this decision is that the reason codes were developed to describe the Deem-milestone (see discussion above) and thus, there is more confidence that Deem-WQP denotes the date the state sets OWQPs as opposed to the Done-WQP.

- If the same milestone and reason code were reported for the same water system, use the earliest date to establish the CCT installation date.

- For systems with a Done-WQP, Deem-WQP, or Done-no reason code date (for systems with a treatment code of "C") of April 11, 2000, subtract out 18 months to account for follow-up monitoring and the State designation of OWQPs. Use the October 1998 date as the CCT installation date unless the system has an early treatment date or resolved CCT violation date. Note that the October 1998 date could potentially be later than the true CCT date by about 1 to 2 years for a small or medium system that exceeded an action level during the first round of monitoring, if the system followed the scheduled as outlined in section 141.81, and both the state and system used the maximum time allotted for a particular step, e.g., 18 months for a study.

B. Approach for Determining CCT Installation Date

For each drinking water system analyzed, a determination was made as to whether the system installed CCT, and if so, when the system installed treatment. The determination was made on the basis of a branching series of Yes/No questions using treatment, milestone, and CCT violation data (type 58 violation) that was reported to SDWIS/Fed. This logical process is represented below as two flow charts (one flow chart for Small and Medium systems and a second for Large systems). A textual description of this logic tree follows.

CCT Date Assignment for Small and Medium Systems

1. If the system reported a treatment code of "C" (code signifies CCT), assume the system installed treatment on or before the treatment date.[17] Attempt to acquire a more precise date by considering the system's history of milestones and violations. However, ***assign CCT to the treatment date*** if the following steps suggest a later date:

    a. If the system reports an end for a CCT violation, assign CCT to the violation end date.

    > **Example:** If the reported treatment date is 2/1/96 and the reported compliance period end date for the CCT violation is 3/21/97, the system would be considered to have installed CCT in Feb 1996. Conversely, if the CCT violation date preceded the treatment date, the treatment date would be used as the CCT installation date.

    b. Otherwise, if the system reports a "DEEM" milestone with reason "WQP", assign CCT to the date of the milestone[18] minus 18 months.

    c. Otherwise, if the system reports a "DONE" milestone with reason "WQP", assign CCT to the date of the milestone minus 18 months.

    d. Otherwise, if the system reports a "DONE" milestone with no associated reason and if a milestone with reason "B1" is not reported within one month before or after the "DONE" milestone, assign CCT to the date of the milestone. In this case, subtact 18 months only if the milestone comes after December 7, 1992.

[17] The "treatment date" is the *FirstReportedDate* for a record with treatment code "C". If there are multiple records, only the one with the earliest *FirstReportedDate* is considered. Note the *FirstReportedDate* is only meant to mark the date the treatment was recorded in SDWIS and may be well after date treatment actually occurred.

[18] The date of the milestone is the *EventActualDate* reported in the SDWIS Events table. If the multiple milestones with the same event code and reason code are reported, only the one with the earliest *EventActualDate* is considered.

Example: The state reported the following milestones for a water system:

- Deem milestone with a reason code of B1 on 12/31/96.
- Done milestone with no reason code on 1/1/97.
- Done milestone with no reason code on 1/1/04.

The state also reports a treatment code of "C" on 3/1/05. No CCT violations have been reported for the system. Because the Deem and 1st Done milestone differ by ≤ 1 month, the system is considered to have met the Done criteria because it was a B1 system.

The system has installed CCT, as indicated by the reported treatment code of 3/1/05. Thus, the 2nd Done milestone, reported on 1/1/04, is assumed to indicate the setting of OWQPs by the state. In this example, the CCT installation date is estimated to be 7/1/02 (the 2nd Done milestone date less 18 months). The reported treatment date is not used because it occurs later than the 2nd Done milestone date.

e. Otherwise, assign CCT to the treatment date.

2. If the system did not report a treatment code of "C", proceed through steps 1a, 1b, and 1c above. If the system fails to meet conditions specified in 1a, 1b, or 1c, then assume that the system did not install treatment.

CCT Date Assignment for Large Systems

1. If the system reported a treatment code of "C", proceed through steps 1a to 1d for Small/Medium systems (for step 1d, the "B1" reason code does not apply) with the stipulation that CCT be assigned to no later than the treatment date. If the system fails to meet conditions specified in 1a, 1b, 1c, or 1d, assign CCT to the treatment date or January 1, 1997, whichever is earlier.

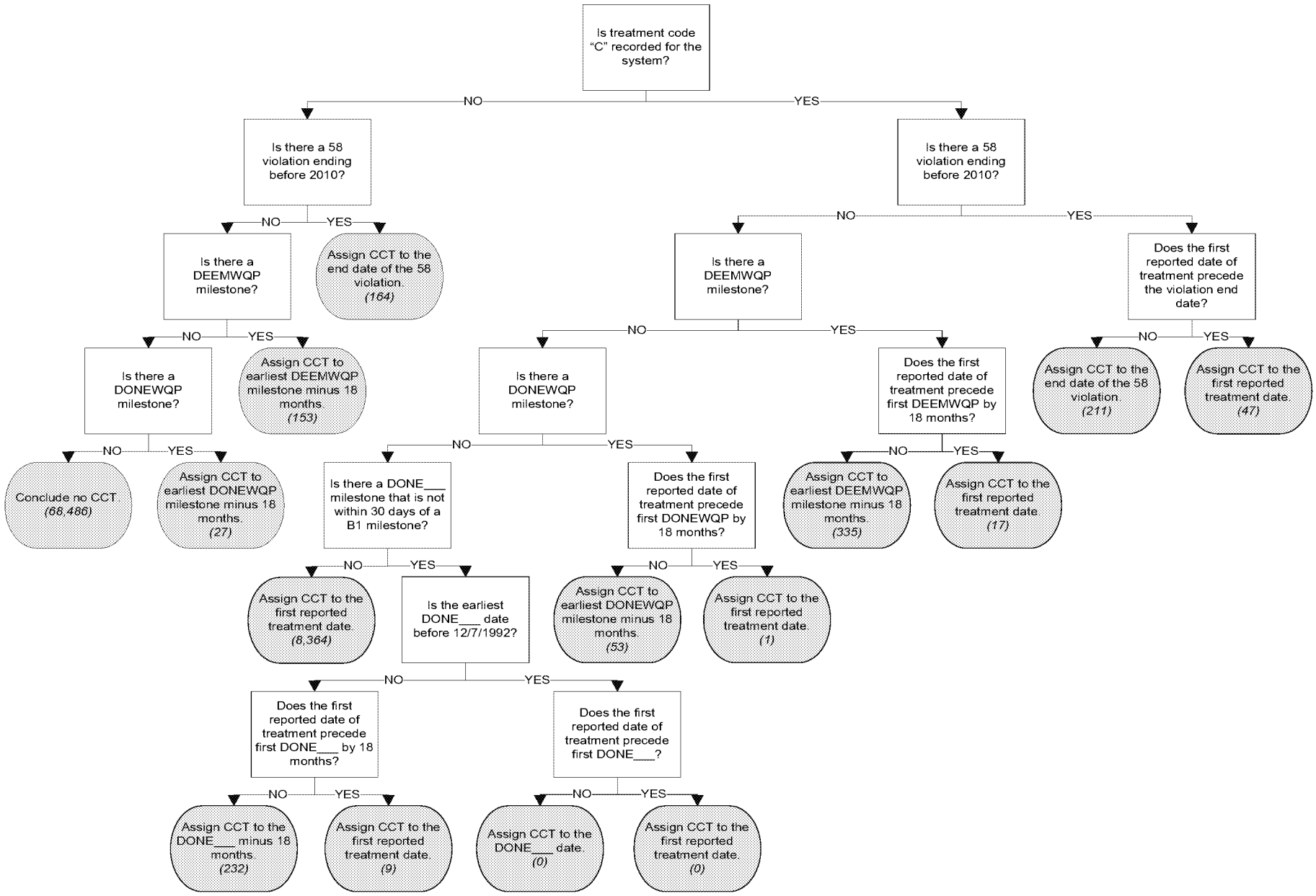
2. If the system did not report a treatment code of "C", proceed through steps 1a to 1c for Small/Medium systems. If the system fails to meet conditions specified in 1a, 1b, or 1c, then check whether the system ever reported a milestone with reason "B3". If it did, assume CCT was not installed. Otherwise, check whether the system has an open CCT violation.[19] If it does, assume CCT was not installed. Otherwise, assign CCT to January 1, 1997.

For both Small/Medium and Large systems, if CCT was assigned to January 2009 or later, then the system is treated as if it never installed treatment because it is outside the period of review considered for this white paper (i.e., December 31, 2008).

[19] If a CCT violation record has a *ComplPerEndDate* greater than June 30, 2009, the system is assumed to have an open violation. If there are multiple CCT violations on record for the system, only the one with the latest *ComplPerEndDate* is considered when determining whether a violation is open.

Logic for Determining CCT Installation Date for Medium and Small Water Systems (serve 25-50,000 people)

(The number is parentheses indicates the number of water systems that met the criteria)



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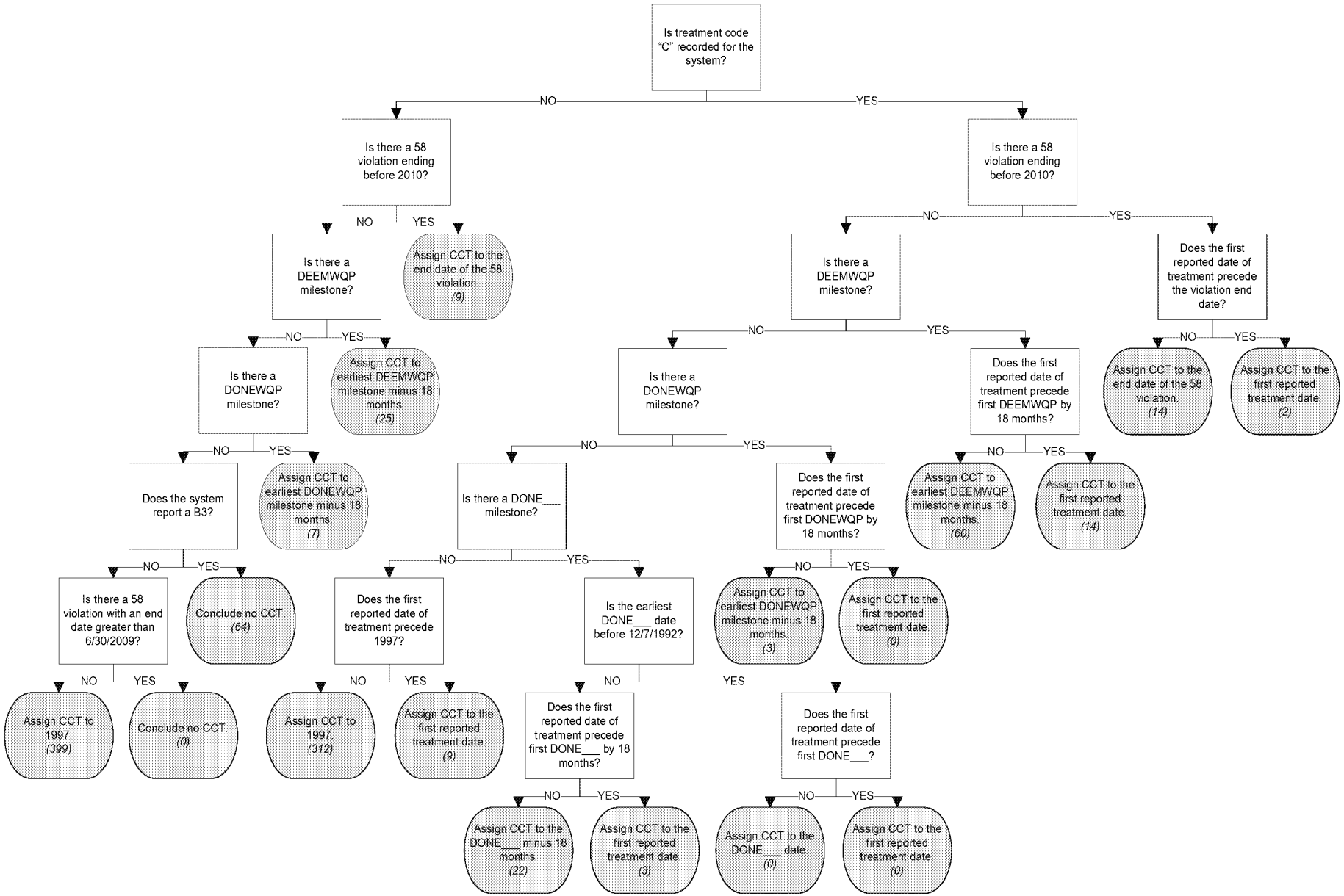
Logic for Determining CCT Installation Date for Large Water Systems (serve >50,000 people)

(The number is parentheses indicates the number of water systems that met the criteria)



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Appendix B
Description of the Quality Assurance Review for the Six-Year Review-ICR Dataset

The bulleted text below outlines that steps that EPA undertook to assess the quality of lead and copper sample results that were submitted in response to the Six-Year Review ICR.

- Samples with lead values reported as <0.00006 mg/L and copper values reported as <0.00005 mg/L (i.e., the method detection limit divided by 10) were screened from the Six-Year-ICR dataset.

- Potential problem high lead concentration results or "outliers" in 34 States were identified. Potential copper "outliers" were identified in 27 States. These outliers were defined as any concentration result greater than 10 times the action level (0.15 mg/L or 150 ppb for lead and 13 mg/L or 13,000 ppb for copper).

- Steps taken to review the data included:
  - All copper concentrations that were greater than 10 times the action level (13 mg/L) were reviewed.
  - All lead concentrations greater than 100 times the action level (1.5 mg/L or 1,500 ppb) were reviewed on a case-by-case basis.
  - The remaining high lead results were reviewed on a global basis (vs. case-by-case).
  - When available, the text version of the analytical record was also reviewed against the numerical version to help identify data entry errors.
  - The reported unit of measure was also compared to other units reported by the PWS.
  - For all copper "outliers" and several lead outliers, the 90th percentile level reported to SDWIS/Fed was compared against the "calculated" 90th percentile in the Six-Year Review-ICR dataset to help determine if a sample was reported in the incorrect units or had a decimal placement error.

- The concentration value was converted (i.e., moved the decimal place to the correct location) if there was strong evidence that the result was a units error. For example, SDWIS/State (the database used by 30 states providing Six-Year data) includes a column of data that lists the concentration value saved as text. This is done to maintain all the leading and trailing zeroes. For instance, for a result that was in the 'text result' column as "0051" but was in the 'numerical result' column as 51 mg/L (and all other results were <=0.05 mg/L), that was strong enough evidence to determine that this was a unit error and this result should be 0.051 mg/L rather than 51 mg/L.

- The concentration value was converted to the correct units if the sample was in different units than the rest of the lead samples from the system and it appeared as if there was a data entry error in the units.

- The concentration value was excluded from the analyses if the sample was marked as an entry point (EP) sample (because this would be indicative of a source vs. tap sample), rather than a distribution system (DS) sample) and it was from a state that distinguishes between EP and DS results and there were other DS samples reported for the PWS.

  Note that the Six-Year Review ICR requested that the sample analysis type indicate whether a sample was "tap" or "source". Only 2 states (of 43 states for lead and of 41 states for copper) used this naming convention. The remainder tended to identify their samples as DS or EP but most states did not use these designations consistently. Thus, the analyses will include some source water sampling data; however, the exact number of samples is unknown. Approximately 7% - 8% of samples in the dataset are identified as EP.

- Most incorrectly reported sample monitoring results were results of data entry or coding error in the State database.

- If there was not strong evidence to either convert or exclude the high result from the analyses, the result was included in the analyses.

Appendix C
Statistical Model of Lead and Copper Concentrations as a Function of Date of CCT Installation

In estimating the effect of CCT installation on lead and copper levels, EPA was confronted with several challenges:

- Only a subset of 90th percentile lead and copper data is required to be reported to SDWIS/Fed (i.e., all lead and copper 90th percentile exceedances and lead 90th percentile levels for large water systems (and for medium water systems after 2000).

- Many of the Six-Year Review sample values are below the method detection limit, which would bias the data if handled improperly (e.g., by excluding these values or assigning them to an arbitrary point between 0 and the MDL).

To overcome these challenges, EPA built a parametric statistical model that allows the effect of CCT installation to be estimated. The model is a member of the "mixed effects" family of parametric models. The model makes the following assumptions:

- Each system has a (long-run) mean concentration of lead and a mean for copper.
- These baseline lead and copper levels are log normally distributed across systems.
- Within a system, contemporaneous variation in concentration around the mean is distributed log normally.
- Across systems, the baseline log concentrations follow a common linear trend.
- The mean baseline for systems that install CCT is different from the mean baseline for systems that do not install CCT.
- The installation of CCT produces a permanent shift in the mean of the log concentration; this treatment effect can differ for copper and lead but is invariant across systems in the same size category.

Given these assumptions, the log of concentration at time t is normally distributed with a mean that is a linear function of model parameters:

$$pdf(\ln y_{it} \,|\alpha_i, CCT, t) = \phi\left(\ln y_{it}\,; \alpha_i + \beta t + \delta 1\{C_i \leq t\}, \sigma_y^2\right)$$

Where:

i = index identifying system

t = index identifying time period (year)

pdf = probability density function

ϕ = normal probability density function

ln y_{it} = log concentration for system i at time t

α_i = (long run) mean of log concentration for system i

β = autonomous rate of change of concentration (slope of trend)

δ = effect of CCT on concentration

1{} = indicator function equal to 1 if its argument is true

C_i = the date that system i installed CCT (set to an arbitrary number above T, the latest date in the sample, if the system did not install CCT during the time observed)

σ_y = standard deviation of the variability of concentration around a system's long-run mean.

Likewise, the distribution across systems of the (long-run) mean is given by:

$$pdf(\alpha_i, CCT) = \phi(\alpha_i; \mu + \gamma 1\{C_{it} \leq T\}, \sigma_\alpha^2)$$

Where:

μ = mean of distribution of systems' (long-run) log concentration means

γ = mean difference between systems that install CCT (at some point) verses those that do not

σ_α = standard deviation of the variability of (long-run) means across systems.

Putting these two pieces together, the basic likelihood of the data given the model parameters is:

$$pdf(\ln y_{it} \,|CCT, t) = \int_{-\infty}^{\infty} \begin{matrix} \phi\left(\ln y_{it}\,; \alpha_i + \beta t + \delta 1\{C_i \leq t\}, \sigma_y^2\right) \times \\ \phi(\alpha_i; \mu + \gamma 1\{C_i \leq T\}, \sigma_\alpha^2) \end{matrix} d\alpha_i$$

This is the likelihood when a level is observed in the data. When the concentration could not be detected, then all that one knows from the data is that the actual level was beneath the minimum detectable limit. Hence, the analyst can aggregate all of the likelihood up to that point to produce the probability of observing a non-detect:[20]

$$Pr(\ln y_{it} \leq MDL|CCT, t) = \int_{-\infty}^{MDL} pdf(\ln y_{it} \,|CCT, t)\, d \ln y_{it}$$

For copper 90th percentile data reported to SDWIS/Fed, where there was not a reporting requirement for concentrations at or below the action level, the censoring point is action level (1.3

[20] For the Six-Year Review lead and copper sample results, the detection limit is usually reported. When the detection limit was not reported, a substitute was used according to the standard procedures for Six-Year Review data. For 90th percentile values reported to SDWIS/Fed, no detection limits are reported for non-detects (when the reported Sample Measure equals zero, the value is considered to be a non-detect). To deal with this shortcoming, EPA used the 5th percentile SDWIS lead detect value as the detection limit for all SDWIS lead non-detects.

mg/L) not the MDL. Lead and copper results are analyzed together; therefore, EPA assumed that every lead entry in SDWIS/Fed had a corresponding copper 90th percentile reading (only copper 90th percentile exceedances are reported to SDWIS/Fed).

EPA handled outliers with an analogous censoring procedure. When the level was so extremely high as to make it implausible, EPA assumed that the data entry was a miscode and censored that observation. EPA assumed that these top-codings censor values exceeding 1.5 mg/L for lead and 13 mg/L for copper.

To estimate the model parameters, identified above, EPA searched for the parameter values that maximize the likelihood of observing the actual data. Because all of the model's parameters vary across size categories and data source (i.e., SDWIS/Fed and Six-Year Review), this estimation was performed 12 times to cover each case: SDWIS lead, SDWIS copper, Six-Year lead, and Six-Year copper each separately for small, medium, and large systems.

Message

From: Steve Via [SVia@awwa.org]
Sent: 10/28/2019 2:13:50 PM
To: Kempic, Jeffrey [Kempic.Jeffrey@epa.gov]
CC: Sierra Dontanville [SDontanville@awwa.org]; Christ, Lisa [Christ.Lisa@epa.gov]
Subject: WQTC Earlybird - Presentation
Attachments: LCR Proposed Revisions Draft Brief_10.25.19.OGWDW.pptx

Jeff,

Should we upload the briefing provided last Friday into the WQTC Ap for next week's earlybird at WQTC?

Jeff - Would you have time to talk a bit about how we should run the session? I am on the road but my cell is Ex. 6 Personal Privacy (PP)

Attached is locked down so it still has the initial event cover page, etc.

In talking with Lisa, I understand that as moderator, I'll need to keep us focused on clarifying questions, but I would like to break the session up into several topics, pausing after each for Q&A. We can probably forgo NTNCWS discussion and put less emphasis on small systems than one might for an ASDWA or internal EPA briefing.

Sierra – Can we change the title to delete the contaminants other than lead

Can we update the description to read:

U.S. EPA will provide an overview of the recently released Long-Term Lead and Copper Rule. The proposed rule changes will impact all water systems subject to the Lead and Copper Rule. The revisions include a number of important changes with pre- / early implementation activity implications by water systems. The earlybird overview will cover each of the major sections of the new rule: monitoring, corrosion control including find-and-fix and re-optimization requirements, lead service lines, and public education including monitoring in schools.

You can list Jeffrey Kempic, EPA as the speaker.

Jeff – is there a particular title, Sierra should use at this point, e.g., LTLCR Technical Team Lead?

Thanks,
Steve

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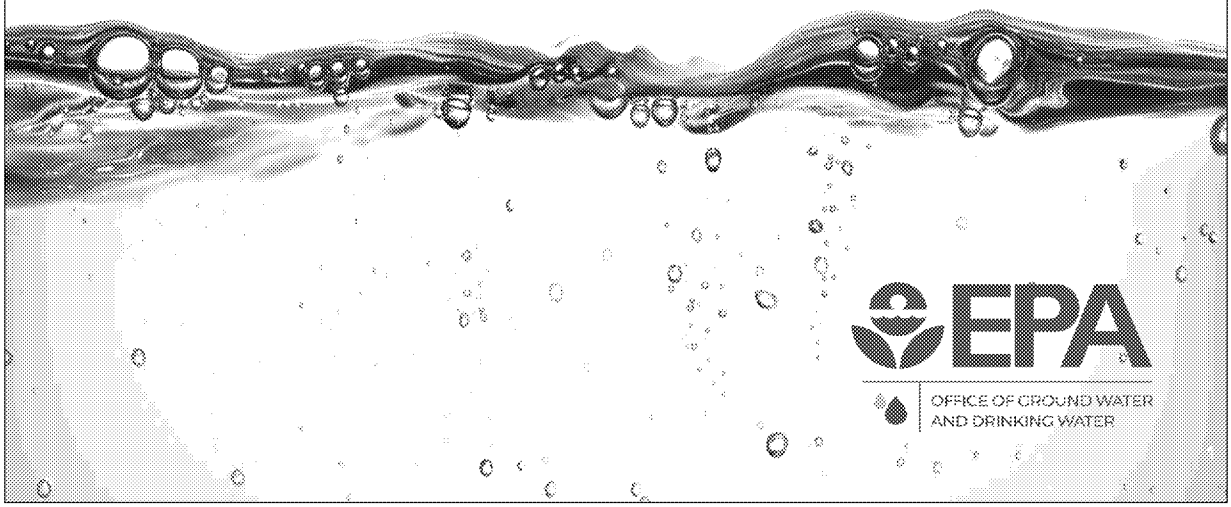
American Water Works Association
Dedicated to the World's Most Important Resource ®

Proposed Lead and Copper Rule Revisions

Version: October 25, 2019



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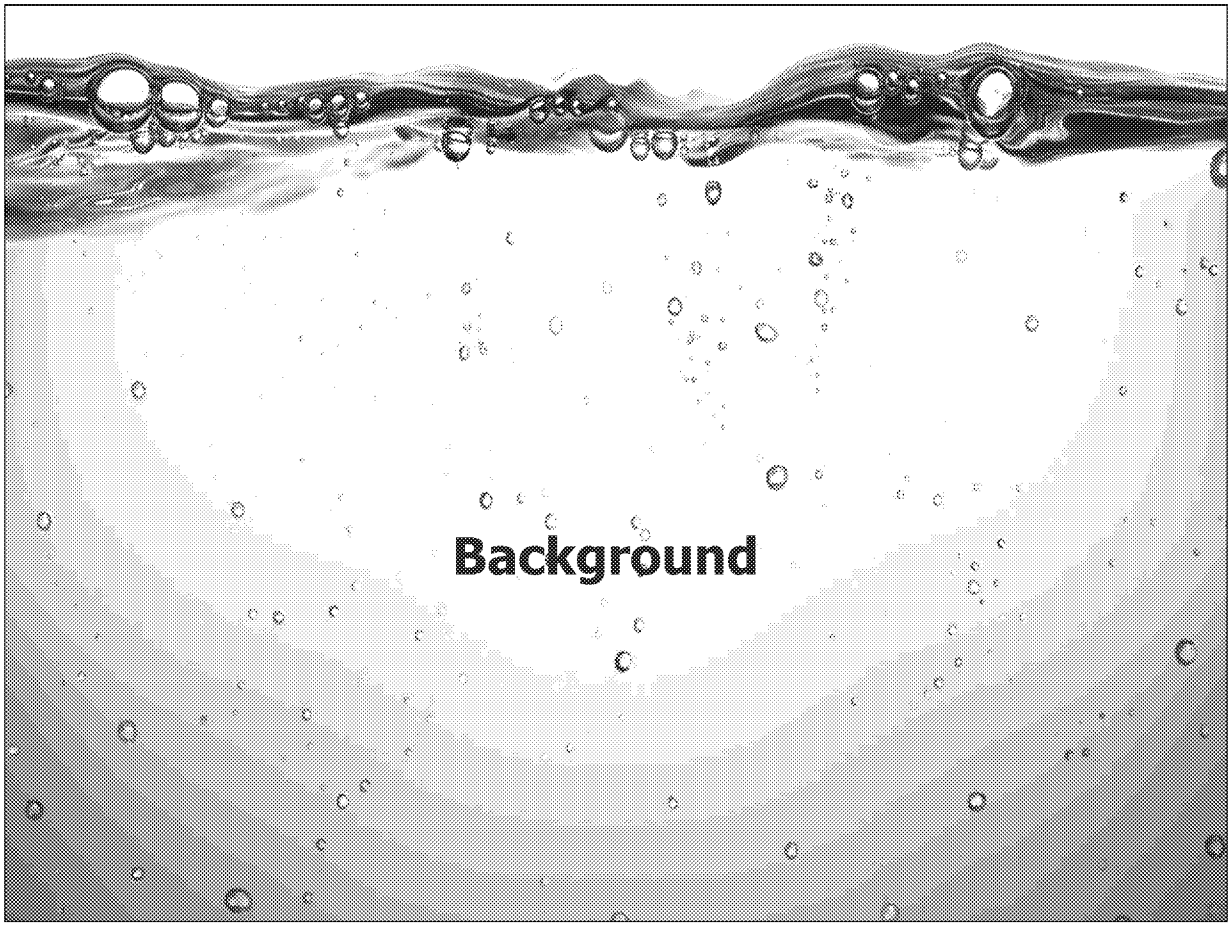
Agenda

- Proposed Revisions Highlights
- Background
- Overview of the Proposed Rule
- Key Requirements and Proposed Revisions
- Additional Information
- Questions

Proposed Revisions: Highlights

- Takes a proactive and holistic approach to improving the current rule—from testing to treatment to telling the public about the levels and risks of lead in drinking water
- Requires earlier action to reduce risks and better protect families
- Includes efforts to improve transparency and communication to help protect children from lead exposure where they live, learn and play


Background

Overview: Current Lead and Copper Rule (LCR)

- Lead is not naturally found in water
- Lead from lead pipes, faucets, and fixtures can dissolve into water or sometimes can enter as flakes or small particles
- To keep lead from entering the water, EPA requires some systems to treat water using certain chemicals that keep the lead in place by reducing corrosion
- When corrosion control alone is not sufficient to control lead exposure, EPA requires systems to educate the public about risks of lead in drinking water and to replace lead service lines

Overview: Current LCR

- LCR was promulgated 1991, revised in 2000 and 2007
- Applies to 68,000 community (CWS) and non-transient non-community (NTNCWS) public water systems serving ~300 million people
- EPA is continuously working with primacy agencies to ensure that the LCR is being properly implemented

Overview: Current LCR

- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L (ppb)
  - Copper - 1.3 mg/L (ppm)

Proposed Revisions: Development

- EPA has conducted extensive consultations regarding potential LCR revisions including:
  - Science Advisory Board
  - National Drinking Water Advisory Council
  - State, Local and Tribal officials
- Based upon this input and experience implementing the LCR, EPA has developed revisions that target actions to reduce lead exposure where it is needed most
- The proposed rule will identify the most at-risk communities and ensure systems have plans in place to rapidly respond by taking actions to reduce elevated levels of lead in drinking water

Proposed Revisions: Summary

- The proposed LCR maintains the current MCLG of zero and AL of 15 ppb but requires a more comprehensive response at the action level and introduces a trigger level of 10 ppb
- The trigger level is a new flexible provision designed to compel water systems to take progressive, tailored actions to plan upgrades to aging infrastructure and reduce levels of lead in drinking water
- This approach focuses on six key areas

Proposed Revisions: Key Areas

1. Identifying areas most impacted
2. Strengthening treatment requirements
3. Replacing lead service lines
4. Increasing sampling reliability
5. Improving risk communication
6. Protecting children in schools

Proposed Revisions: Key Area 1

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Identifying Areas Most Impacted

- The EPA will for the first time require systems to develop a public lead service line inventory and create a plan for removing lead service lines
- Unlike now, systems will have to pay attention to individual locations with elevated levels of lead by identifying the cause and mitigating the problem (find & fix)

Proposed Revisions: Key Area 2

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Strengthening treatment requirements

- Based on sampling results, systems with elevated lead levels will reevaluate their existing corrosion control treatment or conduct a treatment study so that they are prepared to respond quickly when necessary
- Flexibility is important for small systems so that they can protect public health by taking the action that makes sense for their community

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines

- Systems above the trigger level of 10 parts per billion would be required to work with their state to set an annual goal for replacing lead service lines
- Water systems above 15 parts per billion would be required to fully replace a minimum of three percent of the number of known or potential lead service lines annually

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines, continued

- Importantly, the proposal prohibits "test-outs" to avoid replacing lead service lines – an allowed practice under the current rule that has significantly slowed national progress in removing this significant source of lead from our homes
- Partial lead service line replacements will no longer be allowed except in certain situations (e.g., emergency repair) because science has recently shown us that partial lead service line replacement may increase short-term lead exposure

Proposed Revisions: Key Area 4

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Increasing Sampling Reliability

- Water systems will follow new, improved sampling procedures, will adjust sampling sites to better target locations with higher lead levels, and systems with higher levels will sample more frequently

Proposed Revisions: Key Area 5

Improving Risk Communication

- Homeowners will learn about elevated levels of lead in their system sooner
- They will also understand where lead services lines are in their community and how to protect their family from exposure to lead

Proposed Revisions: Key Area 6

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Protecting Children in Schools

- For the first time, systems will be required to test school and child care facilities
- The system would be required to provide the results and information about the actions the school or child care facility can take to reduce lead in drinking water

Proposed Revisions Details

Current LCR: Action Level

- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L
  - Copper - 1.3 mg/L

Proposed Revisions: Lead Trigger Level

- Propose a new Lead Trigger Level (TL) of 10 µg/L
- TL is in addition to the lead action level (AL) of 15 µg/L
- Water systems that exceed the TL but not the AL:
  - No reduced tap sampling, annual at standard number of sites
  - Implement goal based LSLR program
  - Annual outreach to LSL customers
  - CCT study if CCT not installed
  - Re-optimize if CCT is installed

Current LCR: Tap Sampling

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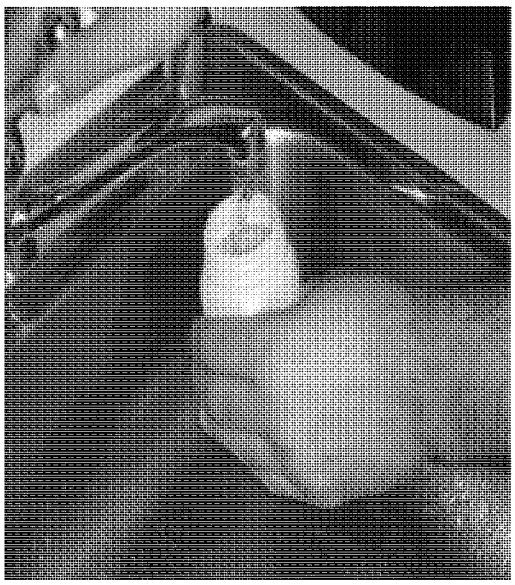
- All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are subject to monitoring requirements
- Systems must collect first-draw samples at taps in homes/buildings that are at high risk of lead and copper contamination



Current LCR: Tap Sampling, continued

- The number of required samples varies by the size of the population served by the system, from 100 samples for large systems serving over 100K people down to 5 samples for systems serving 100 or fewer people
- Systems must conduct monitoring every 6 months unless they qualify for reduced monitoring
- The number of required samples and sampling frequency may be reduced if systems meet certain requirements
- Systems were required to perform a materials evaluation to identify a pool of targeted sampling sites

Proposed Revisions: Tap Sampling

- Lead Service Line Inventory: Require all water systems to create an inventory of lead service lines and update it annually
- Tap sample site selection criteria (tiering)
  - Revise the tap sample site tiering criteria to emphasize sampling from LSL sites
  - Recategorize all copper pipe with lead solder sites regardless of age
- 90th percentile calculation for lead
  - Water systems with LSLs would use 100% tap samples from LSL sites
  - Water systems with insufficient numbers of LSLs collect samples from LSL and non-LSL sites would use the highest non-LSL tap samples
  - Water systems without LSLs would use all tap samples collected

Proposed Revisions: Tap Sampling, continued

- Tap sample collection protocol
  - Prohibit systems from including sampling instructions to remove and clean aerators or to conduct pre-stagnation flushing prior to the start of the required stagnation period
  - Systems must supply samplers/consumers with wide-mouth bottles to collect a tap sample
- Monitoring
  - Systems above the Trigger Level must monitor at least annually (not eligible for reduced triennial monitoring)

Current LCR: Corrosion Control Treatment

- Systems serving > 50,000 people required to begin optimized corrosion control (OCCT) 1994-1998
- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL
  - Systems make optimal corrosion control recommendation to State
  - State approves or designates alternative
  - Follow-up monitoring conducted for one-year

Current LCR: Corrosion Control Treatment, continued

- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL, continued
  - State reviews data and designates optimal water quality parameters (OWQP)
  - Systems maintain OWQP
  - Systems compliance with the treatment technique is based on OWQP AL is exceeded
  - Small/medium systems can discontinue if they meet AL in two consecutive monitoring periods

Proposed Revisions: Corrosion Control Treatment

- Require water systems with OCCT to re-optimize if the 90th percentile lead level exceeds the TL or AL
- Require water systems without OCCT to study OCCT if the 90th percentile exceeds the TL and implement OCCT if the AL is exceeded
- Revise sanitary survey requirements for water systems to include CCT review and WQP assessment, including relevant updated guidance that has been issued by the EPA

Proposed Revisions: Corrosion Control Treatment, continued

- Specify that systems should evaluate an orthophosphate-based inhibitor as CCT (instead of a phosphate-based inhibitor) as part of the CCT study
- Establish additional specifications for water systems to study alternative CCT
- Require systems to conduct "find-and-fix" for individual sites that exceed the AL (See next slide)

Proposed Revisions: Find-and-Fix

- Require all systems to collect a follow-up sample for each lead tap sample site that exceeds 15 µg/L and require systems to subsequently implement a "find-and-fix" approach
- Systems must collect follow-up tap samples within 30 days of learning the results
- Systems would be required to report the results to the state, but the results would not be included in lead 90th percentile calculations

Proposed Revisions: Find-and-Fix, continued

- Systems with CCT would be required to collect an additional WQP sample at or near the site where the high lead sample was collected within 5 days of learning of the lead results
- Systems must determine if a CCT "fix" is needed (e.g., localized CCT change and/or a systemwide CCT change, spot flushing, distribution system operation improvements, system looping and other strategies to reduce dead ends)
- Systems that identify a fix that is out of their control, such as a customer that does not want an old brass faucet replaced, must provide documentation to their state

Current LCR: Notifications & Public Education

- The annual Consumer Confidence Report (CCR) sent to all consumers must include lead sampling results and an informational statement about the health effects of lead and actions to reduce exposure
- Public Notification sent to all consumers if water system has a violation of the treatment technique within 30 days; and notice of violation for failure to monitor or report results within one year

Current LCR: Notifications & Public Education, continued

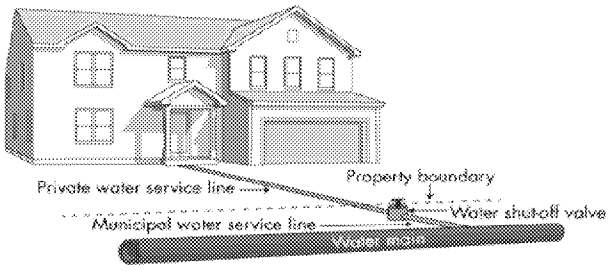
- Systems that exceed the lead action level must begin public education within 60 days after the end of monitoring period:
  - Educational materials must include information on health effects of lead, sources of lead, and steps consumers can take to reduce exposure to lead in drinking water
- Water systems send lead consumer notice with tap sample result to homes where a tap sample is collected within 30 days
- Note that the 2016 Water Infrastructure Improvement for the Nation Act (WIIN) requires notice of a 90th percentile lead level exceeding the AL within 24 hours

Proposed Revisions: Notification and Public Education

- Revise CCR mandatory health effects language and require reporting of the range of tap sample levels in addition to the 90th% and number of samples greater then the lead AL
- Water systems must conduct public notification to consumers within 24 hours of a 90th percentile lead level > AL (WIIN Act)
- Provide notice to customers whose individual tap sample is > 15 µg/L within 24 hours
- Require water systems with LSLs that exceed the TL to conduct annual outreach to LSL customers
- Deliver Public Education (PE) to impacted consumers during water-related work that may disturb LSLs
- Provide public access to LSL inventory

Current LCR: Lead Service Line Replacement

- Systems that exceed the lead Action Level (AL) after installing corrosion control treatment (CCT) must replace 7% of lead service lines per year
- Systems are only required to replace the portion of the LSL owned by the PWS
- Systems may consider an LSL replaced if a sample from that line is below the AL
- Systems must offer to replace customer owned portion at customer cost
- LSLR can stop when lead ≤ AL for 2 consecutive monitoring periods



Proposed Revisions: Lead Service Line Replacement (LSLR)

- Water systems with LSLs would prepare an LSLR program plan and establish an LSLR goal rate with state approval
- Water systems must replace public portion of LSL when customer notifies them of replacement of private portion
- Water systems that exceed the lead TL, but not the AL, would implement the goal based LSLR program
  - Water systems can stop goal based LSLR when system is below the TL for 2 consecutive monitoring periods

Proposed Revisions: Lead Service Line Replacement (LSLR), continued

- Water systems that exceed the lead AL would replace annually 3% of LSLs
  - Water systems can stop 3% annual LSLR when system is below the AL for 4 consecutive monitoring periods
- All LSLR will be full replacements
  - Partial LSLR only for emergency repair or "unwilling or unable customers" when conducting infrastructure replacement (e.g., main replacement)
- Removes the "test out" provision
- Require pitcher filters to be distributed and replacement cartridges by the PWS for three months immediately following lead service replacement

Proposed Revisions: Lead Service Line Replacement (LSLR)

Proposed LCRR:
Requires 3% annual LSLR when lead action level is exceeded

- The entire LSL must be replaced to count towards 3% annual LSLR
- LSLR can stop after **4** monitoring rounds ≤ AL

Trigger Level:

- The entire LSL must be replaced to count towards goal LSLR rate approved by the state

Current LCR:
Requires 7% annual LSLR when lead action level is exceeded

- Allows system to replace only the water system portion of the LSL
- Allows systems to test LSLs and count as replaced if samples are ≤ 15 ppb
- Both of the above allow systems to meet 7% annual LSLR while leaving portions or entire LSLs in place
- LSLR can stop after **2** monitoring rounds ≤ AL

There is no trigger level requiring LSLR

Proposed Revisions: Small System Flexibility

- Applies to CWSs serving 10,000 or fewer persons and all NTNCWS
- Compliance alternatives for small CWSs:
  - full lead service line replacement
  - installation and maintenance of optimized corrosion control treatment, and
  - installation and maintenance of point-of-use (POU) devices

Proposed Revisions: Small System Flexibility, continued

- Compliance alternatives for NTNCWSs:
  - same alternatives as above, and
  - replacement of all lead bearing plumbing fixtures at every tap where water could be used for human consumption
- Water systems with a lead TL would recommend a compliance option and obtain Primacy Agency approval
- If a water system subsequently exceeds the lead AL it must implement the approved option

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

Community Water Systems would

- Develop a list of customers or service connections that provide water to schools or licensed child care providers and verify this list every five years
- Each year, a CWS would collect samples at 20 percent of schools and 20 percent of child care facilities from the list. Therefore, a CWS would collect samples at each facility once every five years
- For each child care facility: collect two samples
- For each school: collect five samples

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

Community Water Systems would, continued

- Provide the EPA's 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach
- Provide sampling results to the sampled facility, Primacy Agency, and state and local health departments
- Annually certify to the Primacy Agency that it met the notification and sampling requirements

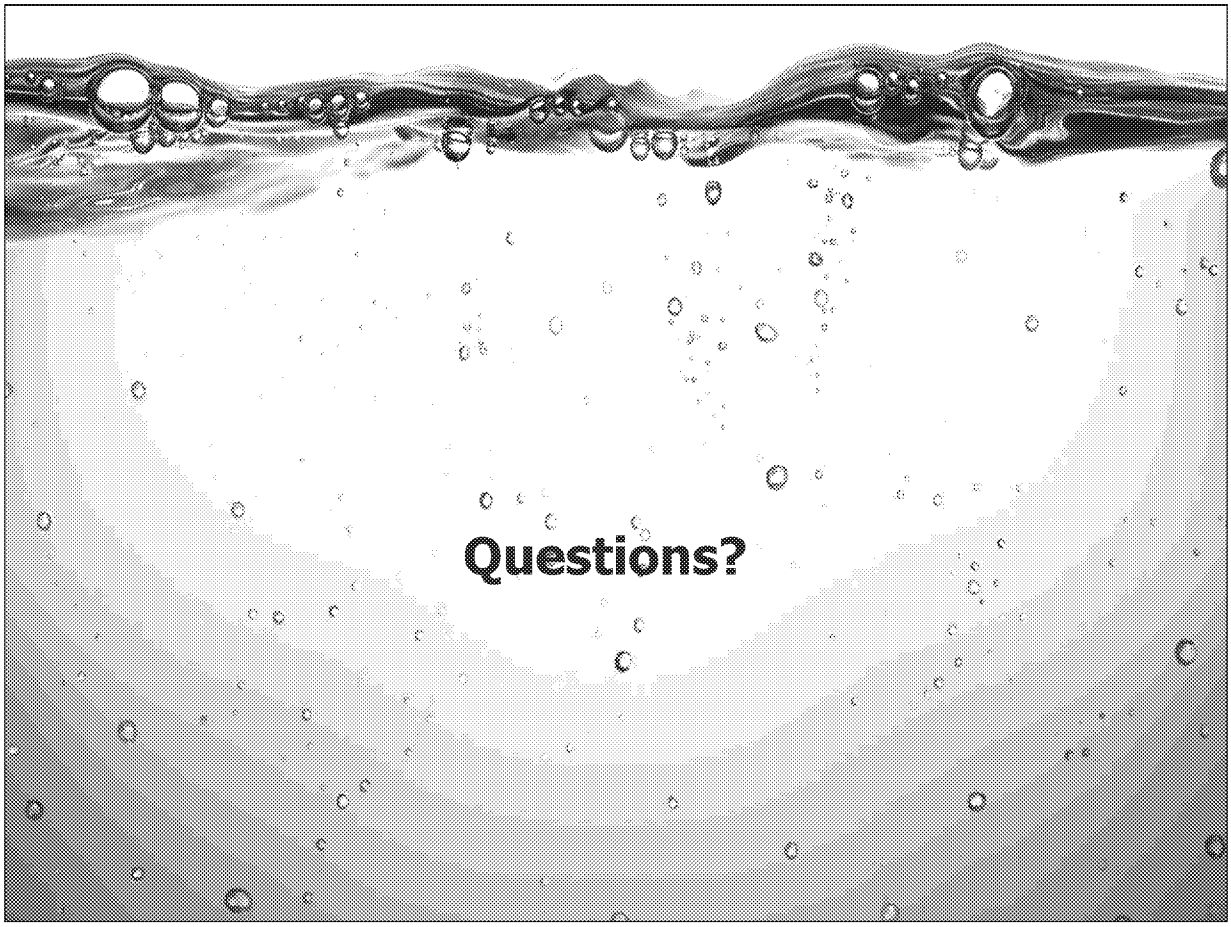
Additional Information

Comparison of Incremental Costs and Benefits for the Proposed Revisions

	3% Discount Rate (2016$)	7% Discount Rate (2016$)
Annualized Incremental Costs	$131 - 270 Million	$130 – 286 Million
Annualized Incremental Benefits	$211 - 521 Million	$36 – 97 Million
Annual Net Benefits	**$79 - 251 Million**	**-$93 – 189 Million**

Next Steps

- Pre-publication version and other materials available at: https://www.epa.gov/safewater/lcrproposal
- Publication in the Federal Register
- 60 day comment period following **publication**
  - Submit your comments at http://www.regulations.gov
  - Docket ID No. EPA-HQ-OW-2017-0300
- Review and evaluate public comments
- Promulgate Final LCR Revisions in 2020


Questions?

Message

From: Steve Via [SVia@awwa.org]
Sent: 2/7/2017 2:35:55 PM
To: Helm, Erik [Helm.Erik@epa.gov]; Christ, Lisa [Christ.Lisa@epa.gov]
CC: Rebecca Morley [rmorley@pewtrusts.org]; Frank Letkiewicz [Frank.Letkiewicz@cadmusgroup.com]
Subject: Use of NDWAC Workgroup Backgrounder
Attachments: Analysis of Impacts of CCT on LC Levels.pdf

Erik / Lisa,

The attached document was prepared by Cadmus and circulated to the NDWAC LT-LCR Revisions Working Group. While it did not get broad distribution it is in effect a public document. Realizing that the white paper was a preliminary analysis, it is the only available analysis of its kind using a relatively modern Six-Year call-in dataset.

Could you advise as to how this document would best be cited and caveated. Rebecca Morley at Pew Charitable Trusts would find it helpful to include this report as a citation in an analysis she is preparing on lead risk reduction opportunities. Peter and Eric are familiar with Rebecca's project and I have cc:ed Rebecca if you have any questions for her.

Thank you for your time and attention.
Steve

Steve Via
Office 202.628.8303 | **Direct** 202.326.6130
Fax 202.628.2846 | **Email** svia@awwa.org

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Analysis of Impacts of Corrosion Control Treatment on Lead and Copper Levels over Time

Summary

Under the Lead and Copper Rule (LCR), water systems are required to collect lead and copper samples at interior taps (e.g., a customer's kitchen or bathroom sink). These "tap" samples are used to help determine whether corrosion control treatment (CCT) is needed to reduce water corrosivity to minimize leaching of lead and copper from plumbing materials. Tap monitoring began in 1992 for systems serving more than 3,300 people and in 1993 for water systems serving 3,300 or fewer people.

In this white paper, EPA presents its evaluation of two important research questions: whether lead and copper levels have declined over time from 1992 to 2008 and whether any decline can be attributed to CCT. Note that the purpose of EPA's analysis was to evaluate the effectiveness of CCT in general, not to examine the effectiveness of specific CCT techniques. This paper also includes a background section that summarizes tap monitoring requirements and the CCT steps; a description and the limitations of the two data sources used for the analyses; and three appendices: Appendix A describes the procedure for estimating the date of CCT installation; Appendix B describes the quality assurance review of the Six-Year Review data; and Appendix C includes a discussion of the parametric statistical model used to assess the effect of CCT on lead and copper levels.

For its analysis, EPA reviewed lead and copper 90th percentile values, milestones, violations, and treatment data reported to the federal State Drinking Water Information System (SDWIS/Fed). As a check on the robustness of these findings, EPA also reviewed lead and copper sample results that some states voluntarily reported for EPA's Six-Year Review process. Data quality (e.g., reporting of incorrect units and dates) and completeness constraints were noted in both data sources, which impacted the accuracy of EPA's assessment.

Approximately 10% of small water systems and 30 % of medium water systems are required to install CCT compared to about 93% of large systems water systems that are required to install CCT. Less than 1% of small and medium water systems and no large water systems have unresolved CCT violations.

Based on the available data, EPA observed an overall decline in lead and copper levels during 1992 through 2008. EPA conducted modeling to assess whether this decline could be attributed to CCT and whether the length of time that CCT had been in place influenced the observed lead and copper levels. Based on its analysis, EPA concluded that some of the decreases in these levels occur in systems without CCT. EPA's model also indicated a statistically significant decline in the

median lead and copper 90th percentile level as a result of CCT across system size categories. The magnitude of the decline ranged from just below 10% for median copper 90th percentile levels for medium systems to more than 40% for median lead 90th percentile levels for small water systems.

When the model was adapted to allow for delayed responses to CCT, the effects grew over time for small systems; in contrast, medium and large systems appear to exhibit an overshooting effect: CCT initially produces a dramatic drop within the first year or two following CCT installation but then rebounds to a higher level that is still lower than the pre-CCT level.

I. Background

The Lead and Copper Rule (LCR) was promulgated to protect public health by minimizing lead and copper levels in drinking water, primarily by reducing water corrosivity. Because lead and copper in drinking water is mainly due to the corrosion of distribution and household plumbing materials, all community water systems (CWSs) and nontransient noncommunity water systems (NTNCWSs) are required to collect first-draw samples at kitchen or bathroom taps of residences and other buildings (i.e, "tap" samples). This sampling requirement began in 1992 for those water systems serving more than 3,300 people and in 1993 for those serving 3,300 or fewer people (see Exhibit I-1 below for the three size categories defined by the LCR and the schedule for initial monitoring).

Exhibit I-1. LCR System Size Categories and Schedule for Initial Monitoring

Size Category		1st Initial Monitoring Period [1]	2nd Initial Monitoring Period
System Size	Population Served		
Large	More than 50,000	1/1/92 - 6/30/92	7/1/92 - 12/31/92
Medium	3,301 to 50,000	7/1/92 – 12/31/92	1/1/93 - 6/30/93 *
Small	25 to 3,300	7/1/93 – 12/31/93	1/1/94 - 6/30/94 *

* Required if either action level is not exceeded during the 1st initial monitoring period, or if required by the state.

The number of samples to be collected by each water system is based on the population served by the water system and whether the system is on standard or reduced monitoring (see Exhibit I-2 below). The lead and copper tap monitoring results are used to calculate 90th percentile lead and copper levels. The 90th percentile levels are compared to their respective action levels of 0.015 mg/L for lead or 1.3 mg/L for copper.[1] All water systems that exceed the lead or copper action

[1] The 90th percentile is calculated by arraying the lead (or copper) sample results from lowest to highest and multiplying the number of valid samples by 0.9. For example, a water system that is required to collect 10 samples will use its 9th highest lead and copper test results as the 90th percentile level (i.e., 0.9 x 10 = 9). For 5 samples, the 90th percentile is computed as the average of the 4th and 5th highest results. For fewer than 5 samples, the highest result is used.

level must initiate corrosion control treatment (CCT) steps. The steps to be completed (e.g., corrosion control study) and their timeline are dependent on the water systems size category (see Exhibit I-3).

Exhibit I-2. Minimum Number of Required Tap Samples by Size

System size *(population served)*	Standard Monitoring *Frequency: Six-months*	*Reduced Monitoring Frequency: Annual, Triennial, or Every 9 Years*
	Number of sites	Number of sites
>100,000	100	50
10,001 - to 100,000	60	30
3,301 - to 10,000	40	20
501 - to 3,300	20	10
101 to 500	10	5
≤100	5	5

Notes:

1. Annual monitoring applies if for 2 consecutive 6-months, the water system is at or below both action levels (applies to ≤ 50,000 people only) or operates its CCT in accordance with its State-specified optimal water quality parameters (applies to any size system with CCT).
2. Triennial monitoring applies if: the criteria listed in Note 1 are met for 3 consecutive years; system meets b3 criteria (see footnote 2); or system qualifies for accelerated reduced monitoring because 90th percentile lead level is ≤ 0.005 mg/L and 90th percentile copper level is ≤ 0.65 mg/L for two consecutive, six-month periods (accelerated reduced provision was added by the 2000 LCR Revisions).
3. 9-year monitoring waiver is available to systems serving ≤3,300 that meet specific non-lead and non-copper plumbing criteria and have lead and copper 90th percentile levels that are at or below 0.005 mg/L and 0.65 mg/L, respectively (waiver provision was added by the 2000 LCR Revisions).

Large water systems that did not have CCT in place prior to the rule's effective date of December 7, 1992 were required to install it by January 1, 1997, regardless of whether they exceeded the lead or copper action level (with an exception).[2] Smaller water systems are required to install CCT only if they have continuing exceedances of their lead or copper action level. Small and medium water systems can discontinue CCT steps if they are at or below both action levels for two consecutive six-month monitoring periods. However, if they have installed CCT, they must continue to operate it. These water systems must recommence CCT anytime they have a lead or copper action level exceedance, beginning with the first uncompleted step or as required by the state.

[2] Large water systems in which the difference between their lead tap samples and highest source water sample results are less than 0.005 mg/L are not required to install CCT (also known as "b3" systems).

Exhibit I-3 shows the schedule for completing CCT steps for those systems that are subject to these requirements.

Exhibit I-3. Corrosion Control Treatment Steps		
Requirement	**Timetable for Completing Corrosion Control Treatment for Systems Serving:**	
	50,000 or fewer people	**More than 50,000**
Step 1: System recommends type of treatment to be installed	6 months	N/A (Part of corrosion control study)
Step 2: State decides whether CCT study is necessary	12 months	N/A (System required to conduct study)
Step 3: System completes study	18 months after State decision to conduct study	July 1, 1994
Step 4: State determines type of treatment to be installed	1. **If study is required:** 6 months after study is completed 2. **If no study is required:** Serves ≤ 3,300: 24 months; Serves 3,301 - 50,000: 18 months	January 1, 1995
Step 5: System installs treatment	24 months after State decision regarding type of treatment to be installed	January 1, 1997
Step 6: System conducts follow-up monitoring	12 months after treatment installation (2 consecutive 6-month periods)	January 1, 1998
Step 7: State designates CCT operating parameters, known as optimal water quality parameters or OWQPs	6 months after follow-up monitoring	July 1, 1998
Step 8: System conducts continued monitoring	The schedule based on whether an action level is exceeded and/or compliance with OWQP ranges or minimums	
Source: Based on Table I-1: *Corrosion Control Treatment Steps in Lead and Copper Monitoring and Reporting Guidance for Public Water System*. EPA-816-R-02-009, February 2002.		

II. Data Sources Used for the Analyses

EPA reviewed lead and copper 90th percentile values, milestones, violations, and treatment data reported to the federal version of the Safe Drinking Water Information System (SDWIS/Fed) for 1992-2008, and Six-Year Review lead and copper sample results for 1998-2005. A more detailed discussion of these two data sources is presented below.

A. SDWIS/Fed

SDWIS/Fed stores drinking water information reported by states to EPA that pertain to PWS inventory, violations, and enforcement actions. Unlike the state version of SDWIS (SDWIS/State) and other state databases, SDWIS/Fed does not include analytical results from individual samples (with the exception of some unregulated data and concentrations for contaminants that exceed

the maximum contaminant level (MCL)). For the LCR, some 90th percentile levels are required to be reported (see 90th Percentile Data below for more detail).

For this white paper, EPA reviewed inventory, 90th percentile lead and copper data, milestone records, two LCR violation types, and treatment information that were reported to SDWIS/Fed (current through June 30, 2009) for 1992-2008. The data were downloaded from SDWIS/Fed on October 1, 2009. Each of these categories of data is described below including their relevance to the analyses presented in Section III.[3]

Inventory

EPA reviewed public water system (PWS) type, status (active or inactive), and population served records that were reported to SDWIS/Fed as of June 30, 2009. These data were used to identify the following universe of water systems to be included in the analysis:

- Active systems or inactive systems with LCR data for 1992-2008.
- CWSs and NTNCWSs that serve 25 or more people.

90th Percentile Data

Individual lead and copper tap sampling results are not reported to SDWIS/Fed -- these data are maintained at the state level. States are required to report to SDWIS/Fed:

- any 90th percentile value that exceed the lead action level of 15 ppb or copper action level of 1.3 mg/L for all system sizes; and
- 90th percentile lead values at or below the lead action level (i.e., non-exceedances) for water systems serving more than 3,300 people only.

States are not required to report copper 90th percentile non-exceedances for any size water system or 90th percentile lead non-exceedances for water systems serving 3,300 or fewer people.[4]

For this analysis, 90th percentile data were plotted for each of the three size categories for 1992-2008 and were used as a measure for identifying changes in lead and copper levels over time (refer to Exhibits III-2A and III-2B in Section III).

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[3] Ohio's data was excluded from the SDWIS/Fed dataset after a review of the state's lead and copper 90th percentile records, which in several instances, appeared to be reported in the wrong units. For similar reasons, Georgia's copper 90th percentile results were also excluded.

[4] The description of the 90th percentile reporting requirements in the paragraph above reflects those specified by the 2000 revisions to the LCR. The requirement to report exceedances to SDWIS/Fed is unchanged from the original rule; however, prior to 2000 revisions, EPA requested 90th percentile non-exceedances for lead be reported to SDWIS/Fed for all large systems, and for medium and small systems once they exceeded the lead action level.

Treatment Data

States must report in SDWIS/Fed treatment information for each treatment plant. EPA identified those water systems with a treatment objective code of "C", which denotes CCT. One limitation of the data is that the date that is associated with the treatment information indicates when the state reported the record to SDWIS/Fed, not necessarily when the treatment was installed by the water system. Thus, the treatment information was used in combination with milestone and violation information to establish the date of CCT installation (refer to Appendix A).

Milestones

Three milestones, Deem, Done, and LSLR are reported to SDWIS/Fed to indicate the initiation or completion of key requirements of the LCR. Because of the ambiguity with the date associated with the treatment objective code of "C", EPA used the milestones in combination with treatment and violation information to help identify those water systems that had or were required to install CCT, and to approximate when treatment was installed. Each milestone is described in more detail below.

- **"Deem"** represents the basis for the State's determination that a system is "deemed" to be optimized under the LCR. Three reason codes are to be reported with this milestone to explain how a system is deemed. Systems with a reason code of WQP have installed CCT.

Exhibit II-1. Reason Codes	
Reason Code	**To Be Reported When:**
B1	A PWS serves ≤ 50,000 and is at or below both action levels for 2 consecutive, 6-month monitoring periods.
WQP	1. A PWS has installed CCT prior to the December 7, 1992; or 2. The State has designated optimal water quality parameters (OWQPs) that define how CCT must be operated.
B3	A PWS that serves > 50,000 people and has minimal levels of corrosion in its distribution systems.

Source: Based on EPA's October 2001 guidance, Appendix B - LCRMR Reporting Guidance

- **"Done"** indicates when a water system has completed all required steps to reduce lead and/or copper levels including implemented optimal corrosion control (i.e., the date the state set OWQPs), completed installation of source water treatment and/or replaced lead service lines (LSLs). The date to be reported corresponds to the latest event that the system was required to complete. Note that in EPA's original October 2001 reporting guidance for the Lead and Copper Rule Minor Revisions (LCRMR), reason codes were not to be reported with the Done milestone; however, the September 2007, Minimum Reporting

Requirements for the Safe Drinking Water Information System (SDWIS/FED) indicates that these codes may be optionally reported for the Done milestone. In addition, as explained in Appendix A, the 2007 guidance redefines the Deem and Done milestones and reason codes.

- **"LSLR"** indicates water systems that are required to initiate lead service line replacement and when this replacement is scheduled to begin.

The lack of a milestone that corresponds directly to the date of CCT installation, changes to milestone reporting requirements and related guidance, and inconsistencies within and among states' interpretation and reporting of these milestones complicate the determination of when CCT was installed. In addition, a system's status can change based on whether the lead or copper action level is exceeded or a system no longer meets its OWQPs. Thus, multiple Done, Deem, and/or LSLR milestones may be reported for the same water system to reflect this change.

For its analysis, EPA used the Done and Deem milestones in combination with treatment and violation information to help identify those water systems that had or were required to install CCT and to approximate when the treatment was installed. This approach is provided in Appendix A.

Violations

States are required to report violations for a water system's failure to meet monitoring or treatment technique requirements. EPA determined the percentage of systems that had one or more lead and copper tap monitoring and reporting (M/R) violations during 1992-2008 to indicate the number of water systems that did not monitor and could potentially have had 90th percentile lead or copper action level exceedances (see Exhibit III-5 in Section III).

Similarly, to provide a more complete picture of the universe that is required to install CCT, EPA also calculated the percentage of systems with unresolved CCT violations as of June 30, 2009. EPA also used the date that a system resolved its CCT violation as one criterion for identifying the date that a system installed CCT (refer to Appendix A).

B. Six-Year Review ICR Dataset

In 2006, EPA prepared an information collection request (ICR) for states to submit compliance monitoring data that were collected by water systems between January 1998 and December 2005. As discussed above, state databases contain individual sample monitoring records as opposed to SDWIS/Fed that includes summary level data (i.e., for lead and copper, 90th percentile levels only). The purpose of this voluntary ICR data request was to help EPA with its charge under the Safe

Drinking Water Act to review existing National Primary Drinking Water Regulations (NPDWRs) at least once every six years, and if appropriate, revise them (i.e., the Six-Year Review).

Forty-three states submitted individual lead sample monitoring data and 41 states submitted individual copper monitoring data. In addition, two EPA Regions also provided individual lead and copper sample results. These data are collectively known as the "Six-Year Review-ICR dataset".[5] The Six-Year Review-ICR dataset does not include 90th percentile level calculations – that information is available from SDWIS/Fed.

EPA plotted the Six-Year Review-ICR sample data for 1998-2005 for each size category as another measure for identifying changes in lead and copper levels over time (refer to Exhibit III-3 in Section III). Refer to Appendix B for description of the EPA's quality assurance review of the Six-Year Review-ICR dataset.

III. Summary of Analyses Conducted

Section III presents analyses related to inventory, 90th percentile lead and copper levels, lead and copper sample data, lead and copper tap monitoring and reporting (M/R) violations, and CCT installation and violation data. This section is divided into the following subsections:

- Distribution of Size Categories in SDWIS/Fed and Six-Year Review-ICR Datasets.
- Lead and Copper Action Level Exceedance Percentages over Time.
- Lead and Copper Levels in Individual Sample Results above the Action Level.
- Correlation between SDWIS/Fed and Six-Year Review Lead and Copper Data.
- Lead and Copper Tap Monitoring and Reporting Violations.
- Corrosion Control Treatment Trends.

Because the rule requirements and resources vary by size category, the exhibits within each of these subsections, in general, display data by each of the three main LCR size categories of large (serve >50,000 people), medium (serve 3,301-50,000 people), and small (serve 3,300 or fewer people). Note that the inventory in SDWIS/Fed is updated quarterly and that the exhibits that display SDWIS/Fed data are based on the SDWIS/Fed inventory that is current through June 30, 2009.

Distribution of Size Categories in SDWIS/Fed and Six-Year Review-ICR Datasets

[5] States not represented include Florida (provided lead results only), Kansas, Louisiana, Maryland, Mississippi, New Hampshire, Pennsylvania, Tennessee (provided one lead result and no copper results), and Washington.

Exhibits III-1A and 1B below display the percent and number of CWSs and NTNCWSs in each of the three LCR size categories in SDWIS/Fed and the Six-Year Review-ICR dataset, respectively. Although the Six-Year Review data set is based on a smaller universe of water systems (i.e., is limited to those 43 states and 2 Regions that provided some lead or copper data), the distribution of systems among the size categories between the two datasets is almost identical. Small water systems comprise the vast majority of water systems in both datasets (89% in SDWIS/Fed and 86% in Six-Year), followed by medium systems at 10 and 12%, and large water systems at 1% and 2%.

Exhibit III-1A. Percent and Number of PWSs in SDWIS/Fed by the Three LCR Size Categories

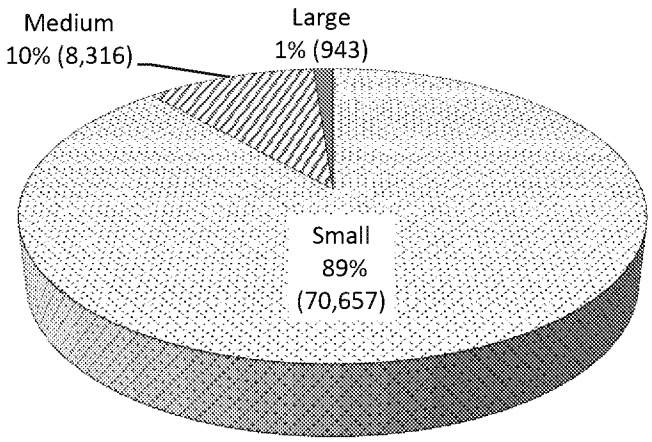
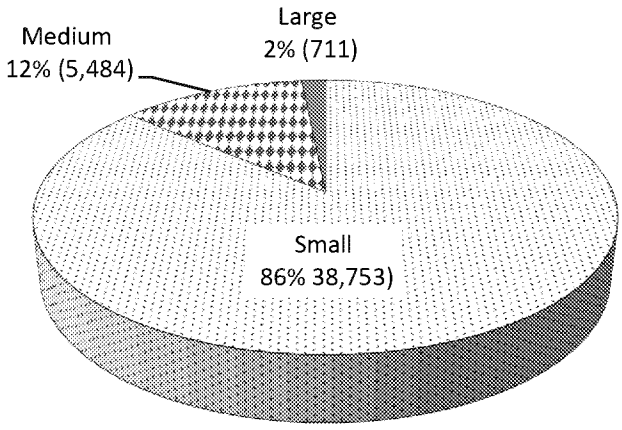


Exhibit III-1B. Percent and Number of PWSs in Six-Year Review-ICR Dataset by the Three LCR Size Categories



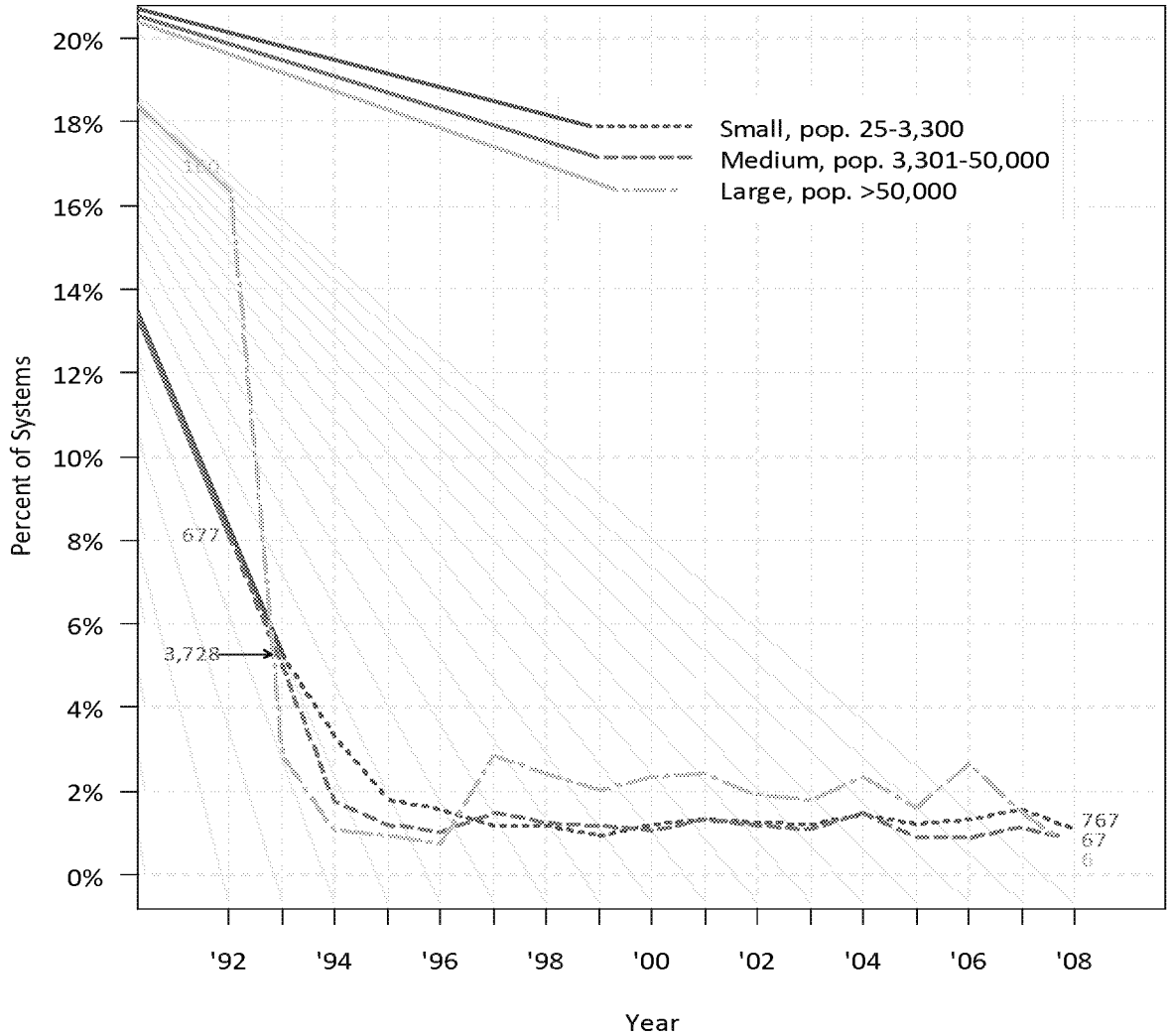
Sources: Exhibit III-1A -- Six-Year Review-ICR Dataset (1998-2005) for 43 states and tribal water systems in EPA Regions 8 and 9; Exhibit III-1B -- October 1, 2009 download from SDWIS/Fed, current through June 30, 2009, and exclusive of Ohio's inventory.
Note: Both pie charts exclude PWSs that were listed as TNCWSs with lead and copper data.

Lead and Copper Action Level Exceedance Percentages over Time

Exhibit III-2A displays the percent of water systems by size category with one or more 90th percentile lead values that are above the lead action level of 0.015 mg/L for a given year during 1992-2008, as reported to SDWIS/Fed. Exhibit 2B presents similar information for copper 90th percentile values that are above the copper action level of 1.3 mg/L. Water systems on semi-annual monitoring with two action levels exceedances are counted once. For systems on triennial monitoring, the 90th percentile lead or copper level is plotted in the last year of the monitoring period.[6] For example, a 90th percentile level that was based on monitoring conducted during January 1, 2002 through December 31, 2004, was plotted as a 2004 result.

Exhibit III-2A. Percent of PWSs by Size Category with Lead Action Level Exceedances during 1992-2008 based on SDWIS/Fed Data

[6] The actual sample date is not reported to SDWIS, only the dates for the beginning and end of the monitoring period. Thus, EPA assumed that monitoring occurred in the last year of the monitoring period.



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009, and exclusive of Ohio's data.

Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data.

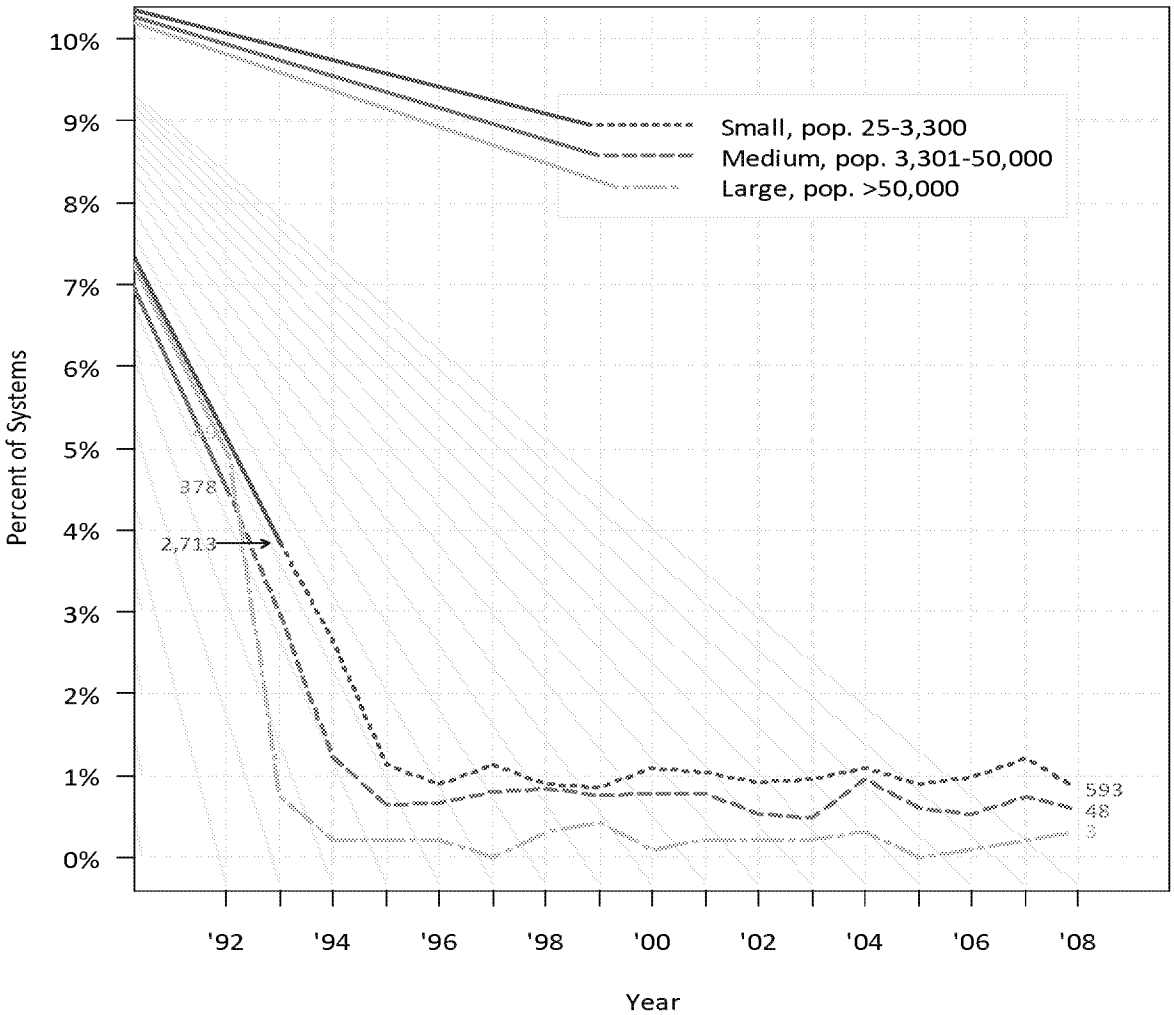
2. Small water systems were not required to begin monitoring until 1993.

3. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

As indicated by the graph above, the largest percentage of lead action level exceedances occurred during the first year of monitoring for all system sizes. Large water systems show the highest percentage of exceedances during the first year. This may be attributed to better reporting for these water systems, partly in response to an EPA press release that identified large water systems that had exceeded the lead action level based on their initial 1992 monitoring data. Another possibility is that large systems are more likely to have lead service lines, which are known to increase lead levels. The drop in levels observed during 1993-1996 for large water systems coincides with the time period in which most large water systems were not required to conduct lead and copper tap monitoring because they were conducting a CCT study and awaiting the state's decisions regarding the type of CCT to be installed (refer back to Exhibit I-3 for CCT step timeline). Medium and small water systems also have the highest percentages of lead action level

exceedances during the first year of monitoring, with the sharpest decline occurring in the two years following initial monitoring. This decline may be attributed to the initiation of CCT steps that do not require tap monitoring by water systems that exceeded the action level, more complete reporting of early monitoring results based on public interest in the rule, and a better understanding of proper sample collection procedures (e.g., instructing consumers to not collect samples after extended periods of non-use).

Exhibit III-2B. Percent of PWSs by Size Category with Copper Action Level Exceedances during 1992-2008 based on SDWIS/Fed Data



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.
Notes: See Exhibit III-2A.

Exhibit III-2B displays a similar decline in copper 90th percentile levels, with the largest percentage of exceedances occurring during the first year of monitoring for all system sizes. A slightly higher percentage of large water systems exceeded the copper action level in 1992 (about 5% compared to ~ 4.5% for medium and just under 4% for small systems). After 1992, the percentage of large

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water systems with copper action level exceedances dropped below that for medium and small water systems. Overall the percentage of systems that initially exceeded the copper action level is lower than those exceeding the lead action level (~17% of large, 8% of medium, and 5% of small exceeded the lead action level). This could be attributed in part to the tiering criteria, which is focused on lead-containing materials (i.e., lead solder prior to the lead ban, sites served by lead service lines). Despite such differences, the overall pattern for copper is very similar to lead.

It is important to note that some systems were in violation of their lead and copper tap monitoring and reporting (M/R) requirements (see Exhibit III-5). If systems had conducted the required monitoring, the percent that exceeded the lead action level would most likely be higher. Thus, these estimates presented in Exhibits III-2A and III-2B should be considered as lower bounds. In addition, some of the peaks and valleys in Exhibits III-2A and III-2B from the mid-1990s for systems serving 50,000 or fewer people and after 2001 for large systems may be attributable to the year in which the 90th percentile result was assigned.[7] For systems on triennial monitoring, EPA assumed that samples were collected during the last year of the three-year monitoring period. In addition, some of the slight increase in the lead and copper action level exceedances during 2004 and 2007 for medium and small water systems) may be due in part to EPA's efforts to improve state reporting of 90th percentile data to SDWIS/Fed.

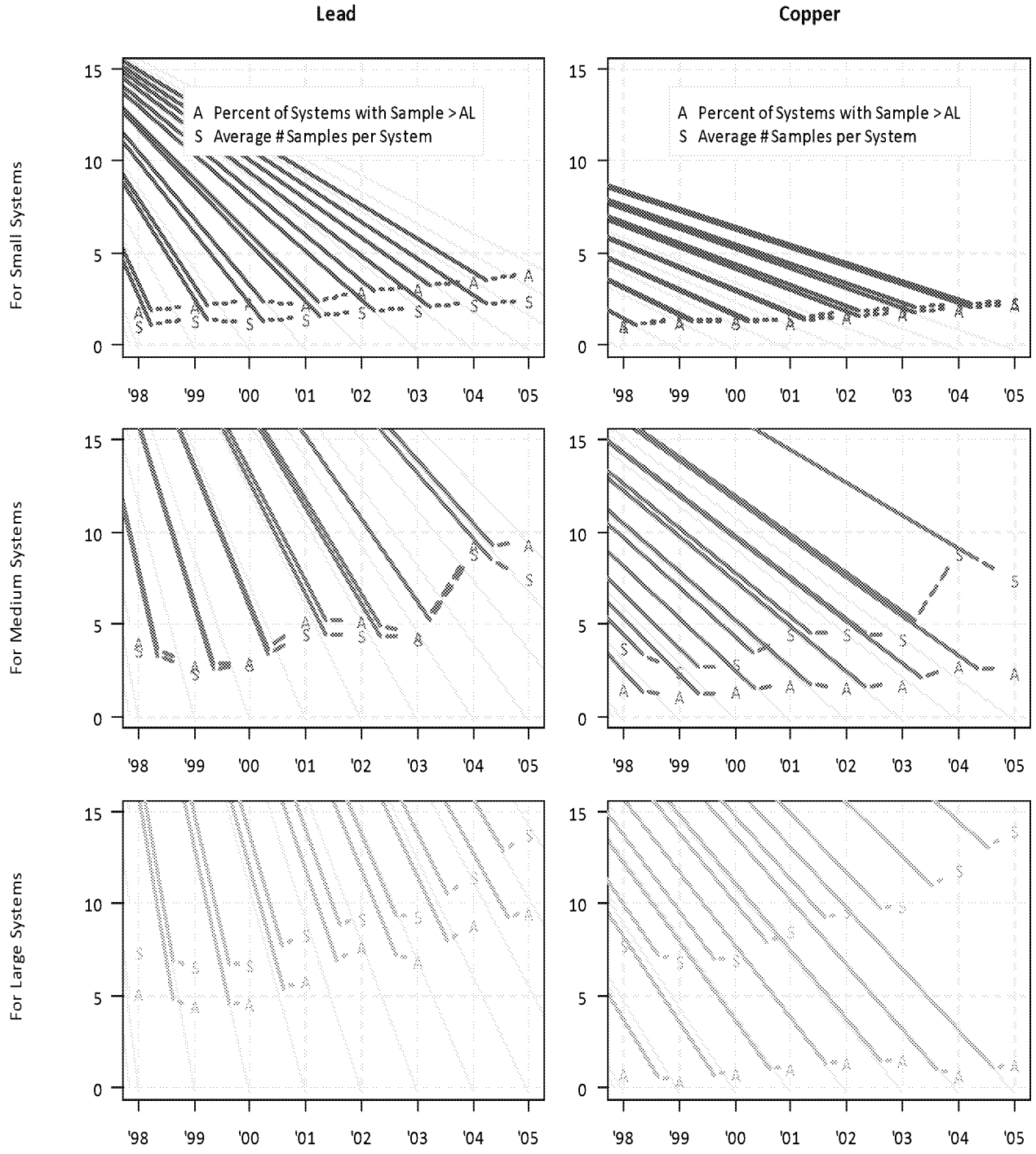
Lead and Copper Levels in Individual Sample Results above the Action Level

Exhibit III-3 plots the percent of systems with one or more samples above the lead or copper action level and the average number of samples reported per system for each year during 1998-2005 for the three LCR size categories based on the Six-Year Review-ICR dataset.

In this data, the percent of systems with one or more sample exceeding the lead or copper action level rose over time. This increase can be attributed to the number of samples reported each year because the probability of a water system having at least one exceedance increases with the number of samples reported. As shown by the average samples per system per year, the amount of sampling data voluntarily reported by states also increased in later years. (Also, refer to Exhibits III-4a through III-4c, which helps illustrate the underreporting of lead sample results in the Six-Year Review ICR data set.)

[7] Assuming that the water systems conducted the required monitoring on time and did not exceed either action level, medium water systems would qualify for triennial monitoring after 1995 and small water systems after 1996. Large water systems that install CCT according to the schedule in Exhibit I-3 and met their OWQPs would qualify for triennial monitoring after 2001.

Exhibit III-3. Percent of Systems with One or More Samples above the Action Level and Average Annual Number of Samples in Six-Year Review-ICR Dataset for 1998-2005



Source: Six-Year Review-ICR Dataset (1998-2005) for 43 states and tribal water systems in EPA Regions 8 and 9.

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Correlation between SDWIS/Fed and Six-Year Review Lead Data

Exhibits III-4a through III-4c shows the correlation between the two data sets that were used for EPA's analysis. Specifically, for each of the three LCR size categories, they indicate how few SDWIS/Fed 90th lead records have corresponding records in the Six-Year Review lead data. To construct these exhibits, EPA considered only those SDWIS Lead 90th percentile records from states that submitted Six-Year Review data and with begin and end dates for the monitoring period that were within the 1998-2005 range. For each remaining SDWIS/Fed lead 90th percentile record, EPA identified matching Six-Year Review records (i.e., had the same system PWSID and a sample collection date that falls within the SDWIS/Fed Lead 90th percentile monitoring period begin and end date). These exhibits show the count of SDWIS/Fed 90th percentile records with matching Six-Year records, broken out by the number of Six-Year records that correspond to each SDWIS/Fed record 90th percentile record. For example, in Exhibit III-4a, the left-most bar indicates that approximately 1,600 SDWIS lead 90th percentile records had no matching Six Year data. The bar labeled 30 shows that 250 SDWIS lead 90th percentile records each had approximately 30 corresponding records in the Six-Year database.

Exhibit III-4a. Number of Corresponding SDWIS and Six-Year Review Lead Records for 1998-2005 for Large Water Systems

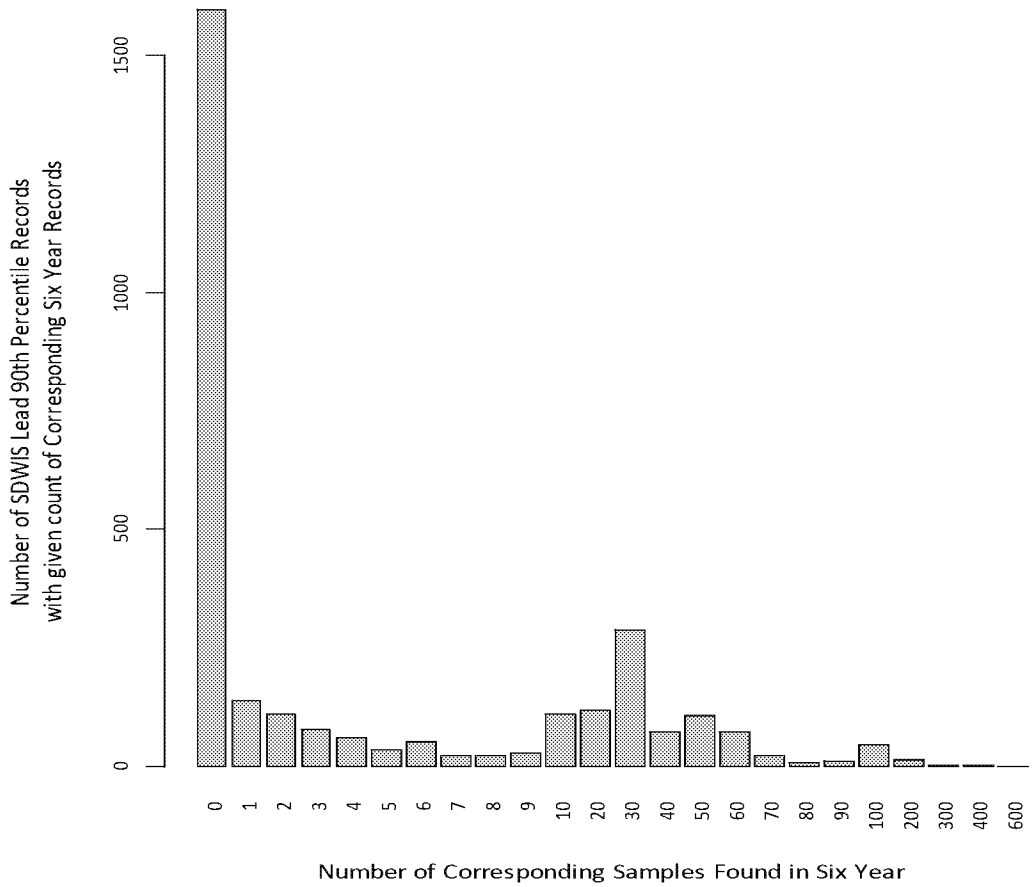


Exhibit III-4b. Number of Corresponding SDWIS and Six-Year Review Lead Records 1998-2005 for Medium Water Systems

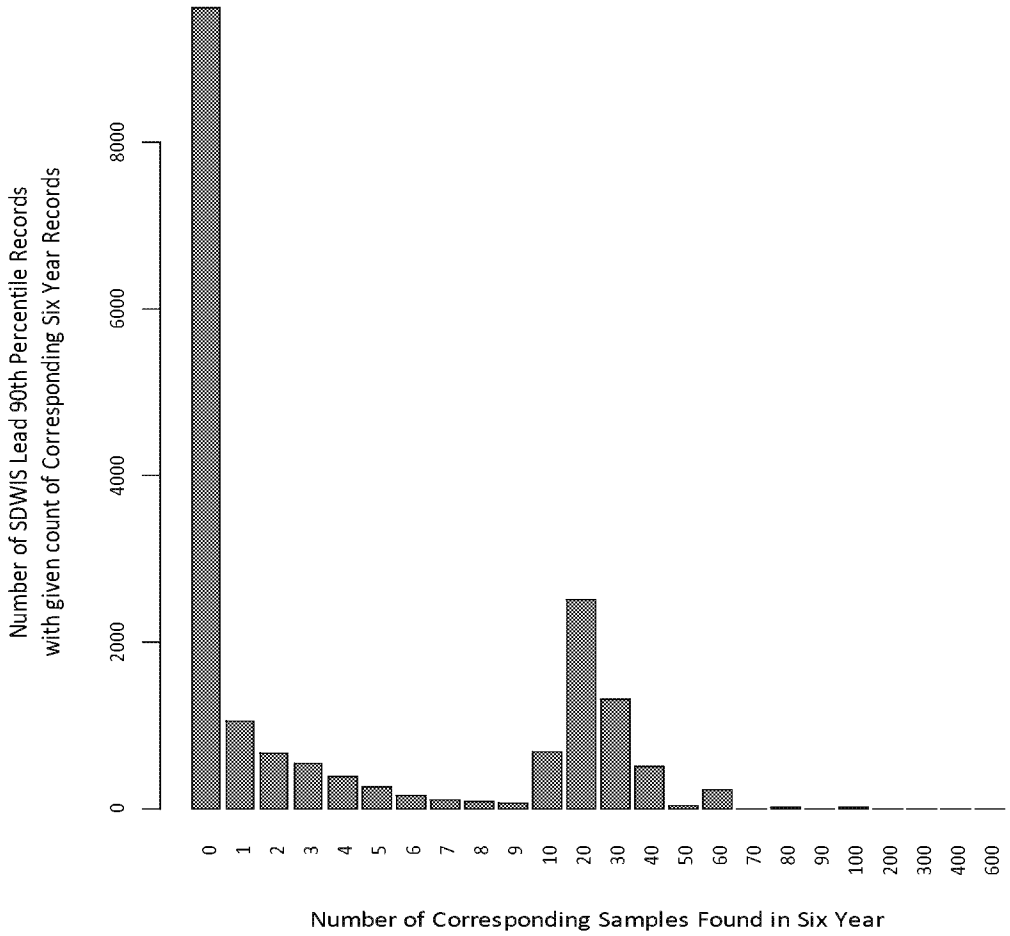
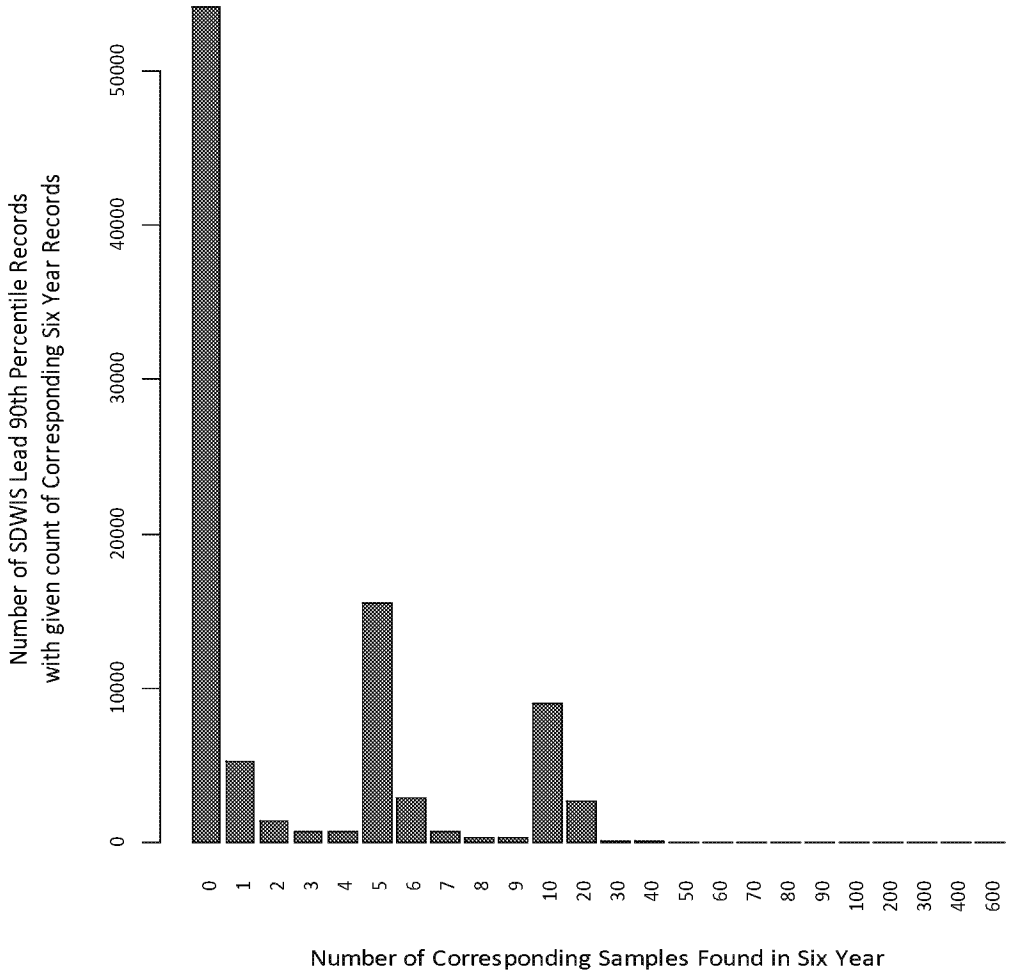


Exhibit III-4c. Number of Corresponding SDWIS and Six-Year Review Lead Records 1998-2005 for Small Water Systems



Exhibits III-4a through III-4c indicate that the majority of 90th percentile lead records reported in SDWIS/Fed do not have corresponding Six-Year Review sample results (approximately 1,600 records for large systems, approximately 9,800 for medium systems, and approximately 54,000 for small systems). In many instances, fewer than the minimum number of required samples were

collected and/or reported (see Exhibit III-4d).[8] Thus, the percentage of systems with samples above the lead (or copper action level) is most likely underrepresented in Exhibit III-3.[9]

Exhibit III.4d: Minimum Number of Required Tap Samples by Size		
System size *(population served)*	Standard Monitoring	Reduced Monitoring
	Number of sites	Number of sites
>100,000	100	50
10,001 to 100,000	60	30
3,301 to 10,000	40	20
501 to 3,300	20	10
101 to 500	10	5
≤100	5	5

Lead and Copper Tap Monitoring and Reporting Violations

The diagram below indicates the percent of small, medium, and large PWSs with one or more tap M/R violations for each year during 1992-2008, as reported to SDWIS/Fed. The percent was derived by dividing the number of systems with violations by the number of CWSs and NTNCWSs in that size category in the June 30, 2008 SDWIS/Fed inventory. For violations, the compliance period begin and end dates are reported to SDWIS/Fed in lieu of the monitoring period begin and end dates. Prior to the 2000 LCR Revisions, the compliance period was the same as the monitoring period. In response to these revisions, the definition for the compliance period begin date was revised to the day after the end of the monitoring period.[10] For example, a water system that was required to monitor during January 1, 2002 through December 31, 2004, and failed to so do, has a compliance period begin date of January 1, 2005. The compliance period end date is defaulted to December 31, 2025. When the system returns to compliance, this end date is replaced with the date the system returns to compliance. This change was made to facilitate tracking the length of time a system is out of compliance.

[8] In Exhibit III-4a, relatively taller bars at 30, 50, 60, and 100 reflect the minimum number of required tap samples for large water systems based on their population served and monitoring schedule (standard or reduced). In Exhibit III-4b, relatively taller bars at 20, 30, 40 and 60 reflect the minimum number of required samples for medium systems based on their population served and monitoring schedule. In Exhibit III-4c, relatively taller bars at 5, 10, and 20 represent the minimum number of required samples for small water systems based on their population served and monitoring schedule. Across all three size categories, systems sometimes take more samples than the minimum number required.

[9] Exhibits III-4a through 4c include only those results that passed EPA's quality assurance review (see Appendix B). Thus, more results were voluntarily provided by the state than plotted in these diagrams. However, in most instances, an incomplete set of sampling results was provided.

[10] In other words, the violation begins immediately after the period during which a PWS was supposed to complete a particular action but failed to do so.

To allow for a more meaningful comparison of how violation rates may have impacted the reporting of 90th percentile levels or lead and copper sample results, violations were assigned within the monitoring period for purposes of this analysis. For PWSs on triennial monitoring, the violation year is the beginning of the three-year monitoring period. In the example above, a water system that was required to monitor during January 1, 2002 through December 31, 2004, and failed to so do, was assigned a violation date of 2002. PWSs on semi-annual monitoring with more than one violation in the same year were counted once.

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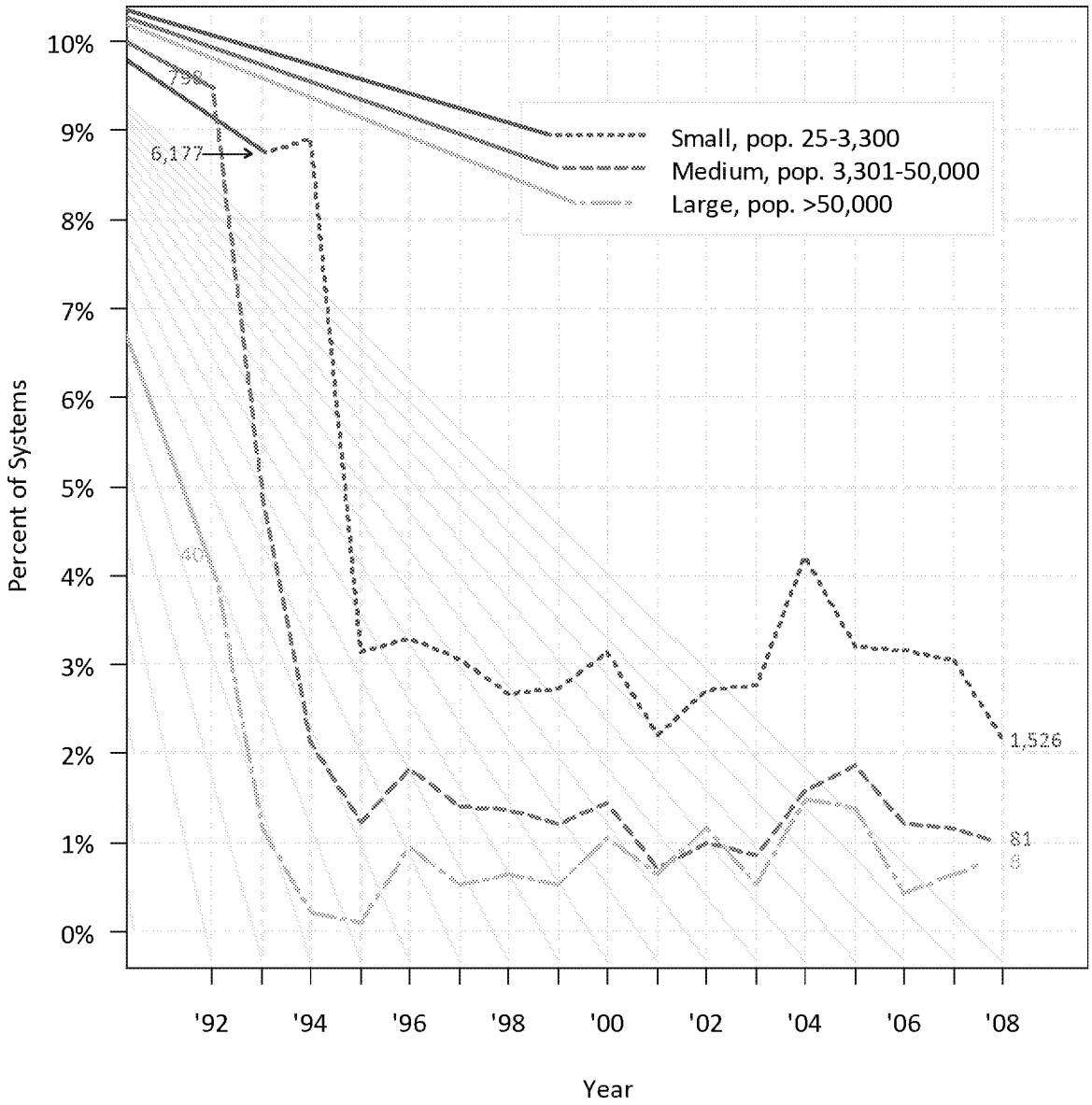
Exhibit III-5. Percent and Number of PWSs by Size Category with Monitoring Violations during 1992-2008 based on SDWIS/Fed Data



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.

Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data, PWSs in Ohio's inventory, and those violations with a compliance period end date prior to 1992 or after 2008.

2. Small water systems were not required to begin monitoring until 1993.

3. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

The highest percentage of violations occurred during initial monitoring, which is to be expected with the implementation of a new regulation. The percent of all violations rose slightly in 2004. This increase may be due in part to the year in which the violation was assigned for systems on triennial monitoring (i.e., during the first year of the three-year monitoring period) and to EPA's efforts in 2004 to improve state reporting of 90th percentile data to SDWIS/Fed.

Because the constructed violation percentage includes all water systems in a given size category in the denominator, even through systems on triennial and nine-year monitoring schedules are not required to perform monitoring every year, the frequency of violations may be understated by a factor between 2 and 3. Unfortunately, the various monitoring schedules for each PWS are not available in SDWIS/Fed and hence this more accurate calculation cannot be performed.

Corrosion Control Treatment Trends

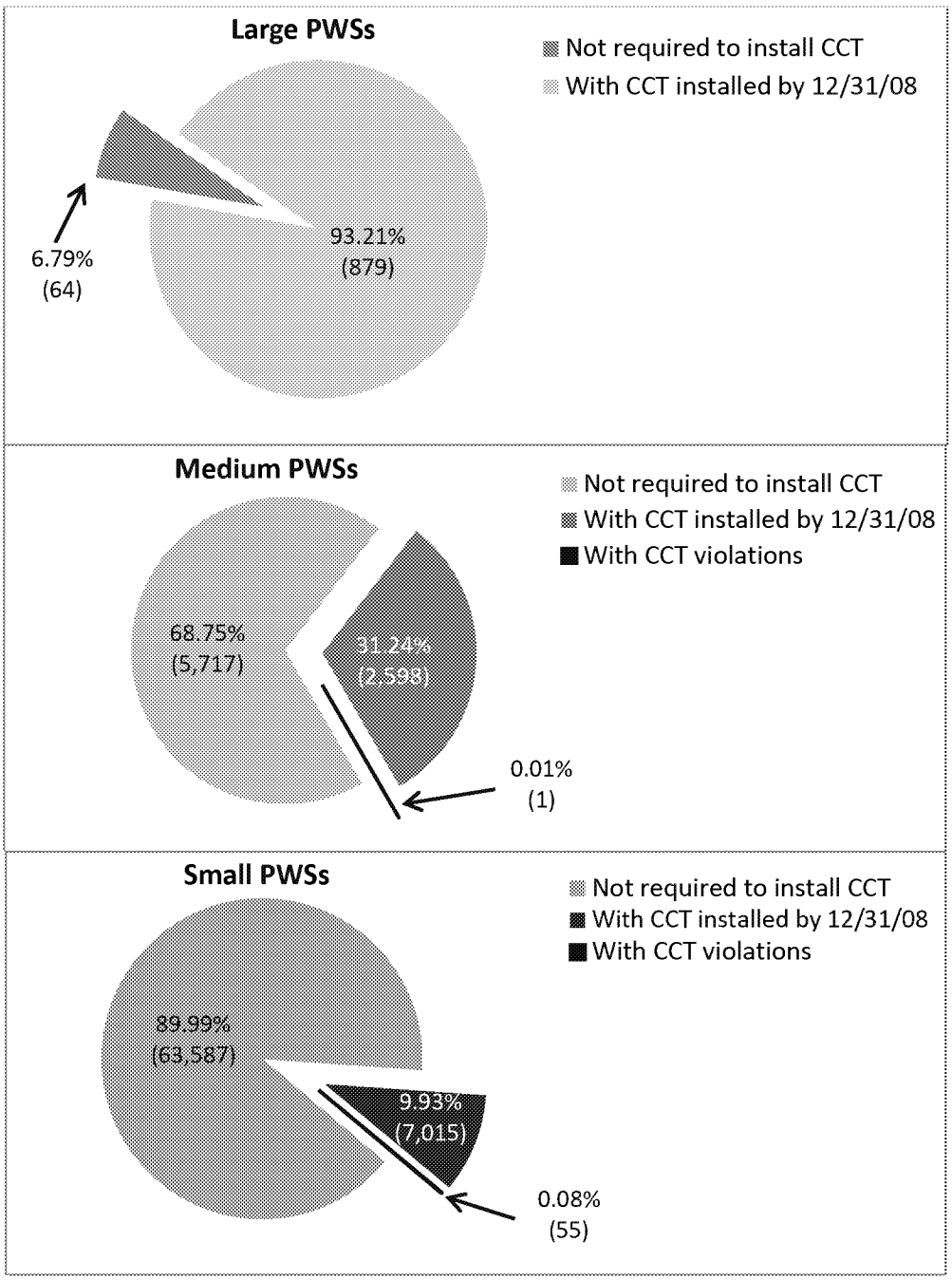
A. Universe of Systems Installing CCT

Exhibit III-6 indicates the percentage of systems by LCR size categories that belong to three different CCT categories: those that installed CCT by December 31, 2008; those that were not required to install CCT; and those had unresolved CCT installation violations as of June 30, 2009. A system was counted as not required to install CCT if it had none of the following: an unresolved CCT violation[11], a treatment code of "C", or a reason code of WQP for a DEEM or DONE milestone.

As discussed in Section I - Background, large water systems are required to install CCT regardless of whether their 90th percentile lead or copper value exceeds their action level with the exception of those that qualify as "b3" systems. Small and medium systems that continue to exceed one or both action level are required to install CCT. Approximately 90% of small water systems and 69% of medium water systems are not required to install CCT compared to approximately 7% of large systems. Less than 1% of small and medium water systems and no large water systems have unresolved CCT violations.

[11] Water systems were also counted in the category of not required to install CCT if they corrected their CCT violation in January to June 2009 and did not have a treatment code of "C" or a Deem or Done milestone with a reason code of WQP. The rationale for this decision was twofold: 1) 2009 is outside the time period of EPA's analysis; and 2) a medium or small water system could resolve its CCT violation by no longer being subject to the CCT requirements (at or below both action levels for two consecutive six-month monitoring periods).

Exhibit III-6. Comparison of the Number and Percent of Water Systems that Have or Are Required to Install CCT



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.

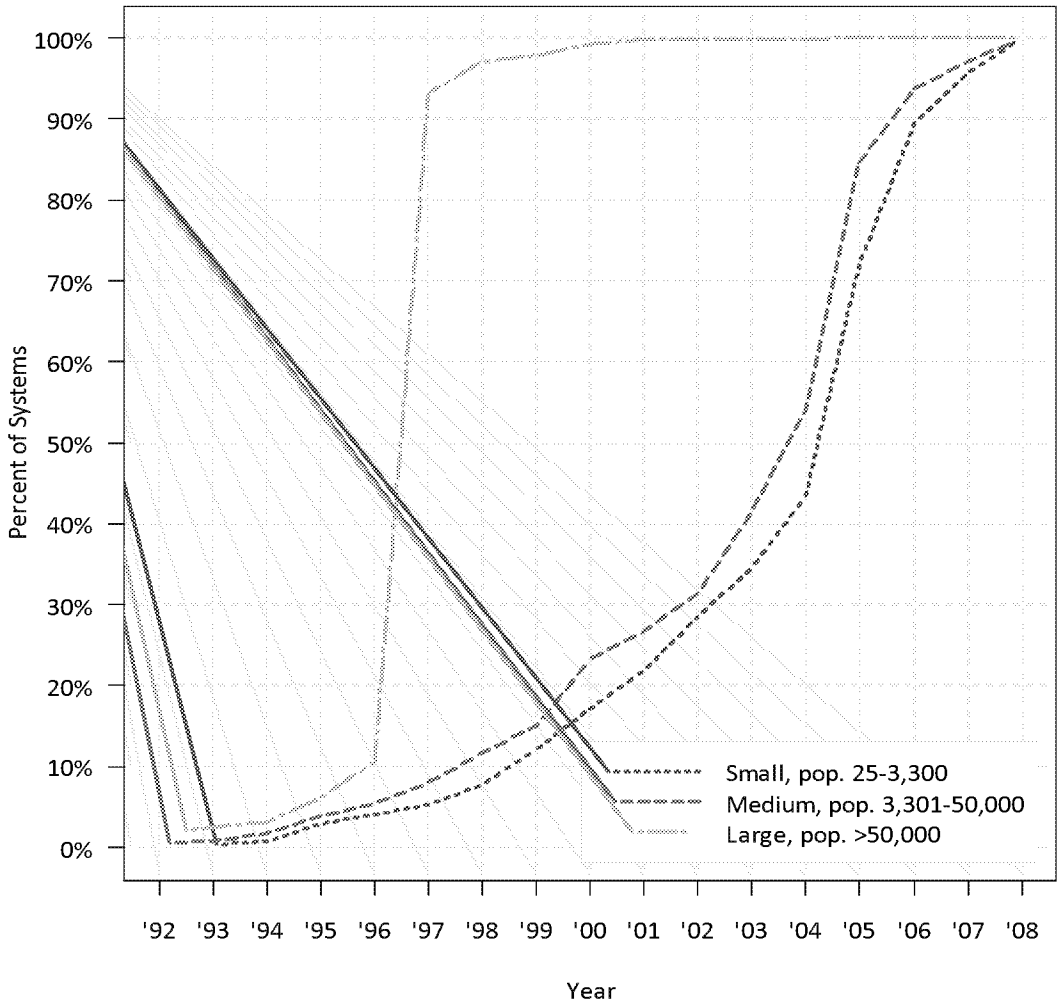
Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data, PWSs in Ohio's inventory, and those violations with a compliance period end date prior to 1992 or after 2008.

2. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

B. Timeline for Installing Treatment

Exhibit III-7 illustrates the year in which small, medium, and large water systems installed CCT (i.e., the step in the CCT process that occurs prior to the collection of follow-up monitoring and the state's designation of OWQPs). The exhibit does not include water systems that were not required to install CCT, have not installed this treatment by 2008, or which have outstanding CCT violations (see Exhibit III-6 for CCT violation percentages). Also, refer to Appendix A for a discussion of how the CCT dates where determined.

Exhibit III-7. Timeline for Installation of CCT by System Size for 1992-2008 based on SDWIS/Fed Data



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009.

Notes: 1. Graph excludes PWSs that were listed as TNCWSs with lead and copper data, PWSs in Ohio's inventory, and those violations with a compliance period end date prior to 1992 or after 2008.

2. Percentages are based on the SDWIS/Fed inventory as of June 30, 2009.

The graph indicates that the majority of large water systems installed CCT during or before 1997, with approximately 2% installing the treatment prior to 1992. As previously discussed in the Section I - Background, large water systems were required to install CCT by January 1, 1997. As described in Appendix A, large water systems were assumed to install CCT on January 1, 1997 unless violation, milestone, and/or treatment information had been reported to SDWIS/Fed that indicated that this CCT had been installed during a different year.

For medium and small water systems, the LCR does not specify an exact date for CCT installation but outlines the timeframe for water systems and states to complete specific CCT steps, as well as the criterion for discontinuing and recommencing these steps. Approximately half of the medium and small water systems that had installed CCT did so by 2004, with this number jumping to 80% in 2005 for medium systems and 2006 for small systems.

C. Impact of CCT on Lead 90th Percentile Levels for Large Systems

Exhibit III-8 below shows the estimated effect of CCT on 90th percentile lead levels for all large water systems including those with and without CCT. This exhibit is limited to large water systems because they were the only size category for which both exceedances and non-exceedance lead levels were consistently reported (because they were requested prior to 2000 and required thereafter).[12] Thus, a comparable exhibit cannot be provided for copper because only those 90th percentile copper levels that exceed the action level are required to be reported to SDWIS/State for all system sizes.

The three plotted lines demonstrate the following:

- Lower quartile – indicates the level below which 25 percent of all large systems' 90th percentile levels fall for a given year. For example, in 1992, 25% of all large system's 90th percentile lead levels were 4 µg/l or less. In 1994, 25% of these values were ~2.5 µg/L or less.

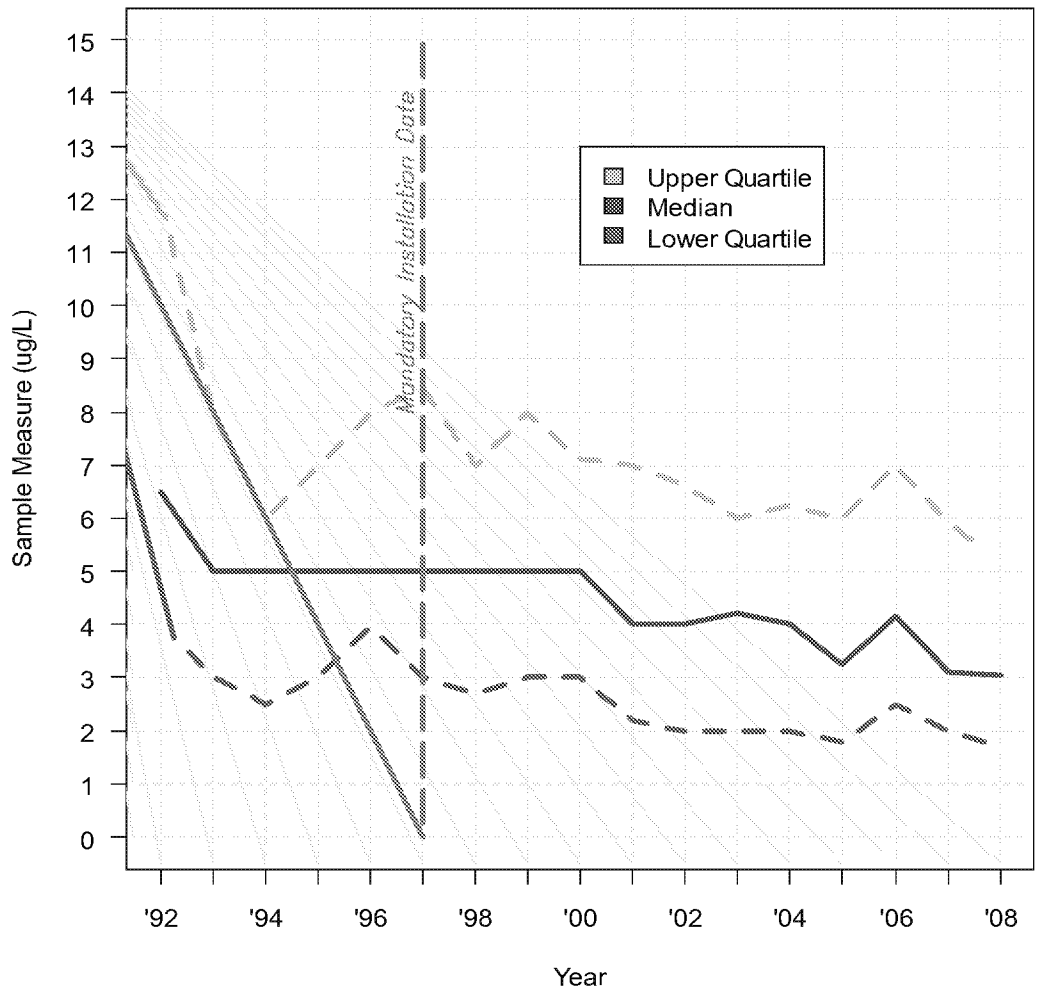
- Median – indicates the midpoint for all 90th percentile lead levels below which 50% of all large systems' 90th percentile levels fall.

[12] As explained in Section I, prior to 2000 LCR Revisions, EPA requested that states report 90th percentile non-exceedances for lead to SDWIS/Fed for all large systems, and for medium and small systems once they exceeded the lead action level. With the 2000 LCR Revisions, states are required to report SDWIS/Fed any 90th percentile values that exceed the lead or copper action level and those 90th percentile lead levels that are at or below the action level (i.e., non-exceedances) for water systems serving more than 3,300 people. Neither the original rule nor 2000 Revisions require states to report copper 90th percentile non-exceedances for any water system or 90th percentile lead non-exceedances for small water systems.

- Upper quartile – indicates the level below which 75 percent of all large systems' 90th percentile levels fall for a given year. For example, in 1992, 25% of all 90th percentile lead levels were 12 µg/l or less.

If a system reported multiple values in a given year, then the system's level for that year was represented by the median of the values it reported that year. The diagram also indicates the rule mandated date by which water systems must install treatment. As shown in Exhibit III-8, approximately 95% of large water systems that installed CCT were estimated to install this treatment by the mandatory date of 1997 (refer to discussion in previous section regarding the use of 1997 as a default date). However, a small percentage installed significantly before or after 1997 or outside the 1992-2008 analysis window entirely. The exhibit shows an overall decline in lead 90th percentile levels in large systems.

Exhibit III-8. Upper and Lower Quartile, and Median Lead 90th Percentile Levels for Large Water Systems



Source: October 1, 2009 download from SDWIS/Fed, current through June 30, 2009, and exclusive of Ohio's data.
Notes: Graph includes CWSs and NTNCWs regardless of CCT installation date.

D. Modeled Effect of CCT on Lead and Copper 90th Percentile Levels and Sample Results

Exhibit III-9 displays the results of a parametric statistical model that EPA used to estimate the percent change in lead and copper levels as a result of CCT installation (see Appendix C for a description of the model). The model accounts for the censoring of data by detection limits and reporting requirements.[13] It also accounts for the fact that different systems have different long-term means and that lead and copper concentrations may drift downward or upward during the reporting period regardless of whether the system has installed CCT. If a system installed CCT before 1992, then all of its observations were considered to be post-CCT.

The model's parameters were fitted using maximum likelihood estimation, with a separate parameter search conducted for each of 12 different subsets of data – one model for each combination of contaminant (lead or copper), dataset (SDWIS or Six-Year), and system size (small, medium, or large) (2*2*3=12). For each data subset, the plot indicates the central estimate of the effect of CCT with a short black horizontal bar. The estimate is surrounded by a colored box, which bounds the model's 50% confidence interval for the statistic. The whiskers extend to cover the 95% confidence interval. The 50% confidence interval and the 95% confidence interval are measures of uncertainty.

Based on the SDWIS/Fed data, the model results show that CCT resulted in a drop in lead 90th percentile levels, ranging from just below 10% for large systems to more than 30% for small systems. The model results also show that CCT resulted in a drop in copper levels, ranging from 10% for medium systems to over 40% for large systems. In contrast, the model results using Six-Year Review-ICR data is mixed. For the most part, CCT was found to lower lead and copper levels; but there are two notable exceptions: lead levels for medium systems and copper levels for small systems. Most likely, these aberrations are due a sample selection effect in the data that got reported for the Six-Year review.[14]

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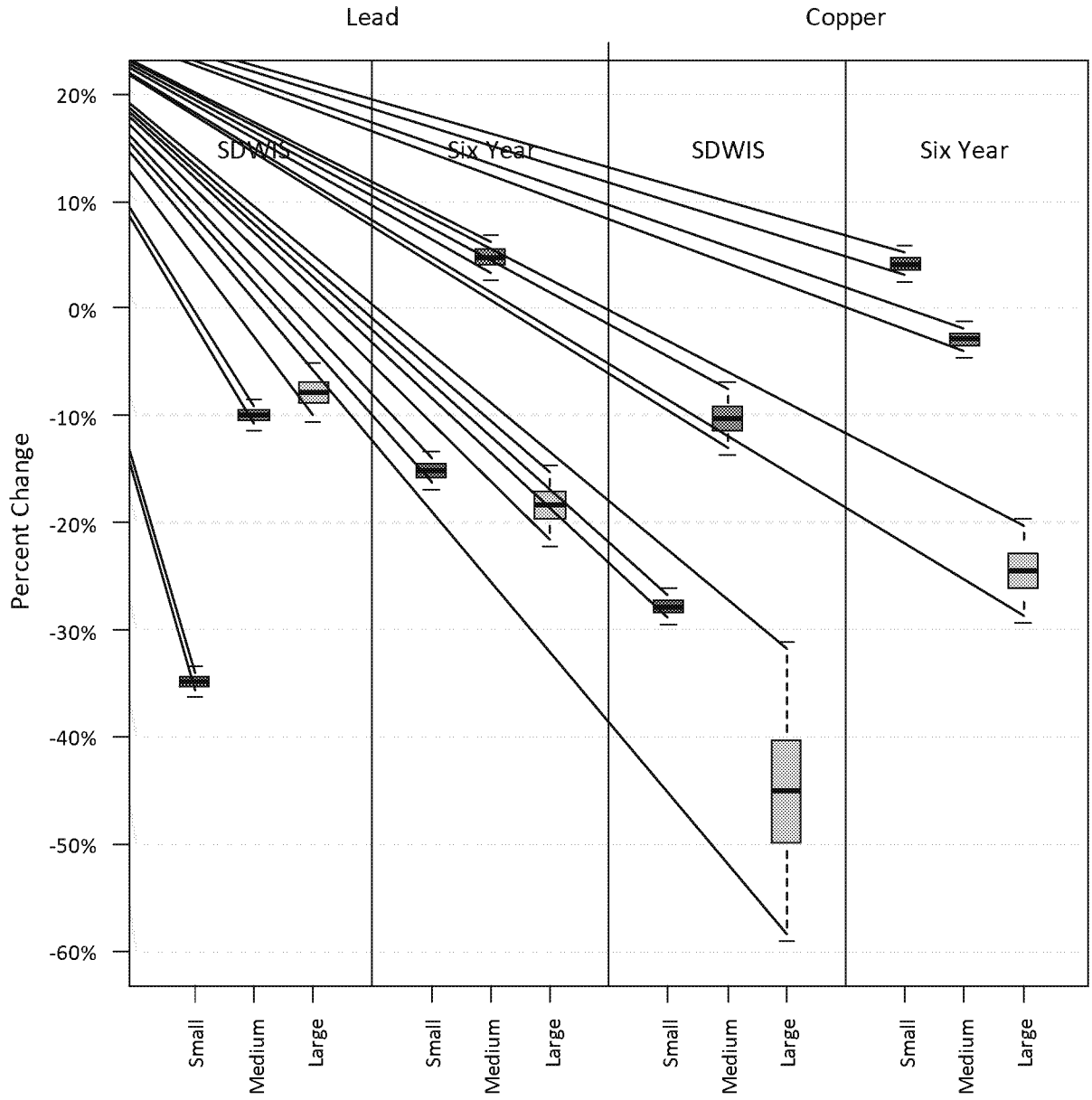
[13] Censoring occurs when the true value of a data point, the concentration of lead or copper in this case, is unobserved by the analyst, who only knows that the level fell within a range. For instance, if the concentration was below the detection limit, then the analyst does not observe the actual concentration but rather observes the minimum detectable limit.

[14] A sample selection effect occurs when the observations appearing in the sample are not representative of the population. In this context, systems with lower concentrations are over-represented in the earlier years compared to later years when more data were reported. In that case it would appear (erroneously) that levels had risen over time due to CCT, rather than the actual reason for the increase, which is due to changes over time in the composition of number and size category of systems conducting the monitoring).

Exhibit III-9. Modeled Effect of CCT on Lead and Copper Levels based on SDWIS/Fed and Six-Year Review-ICR Dataset

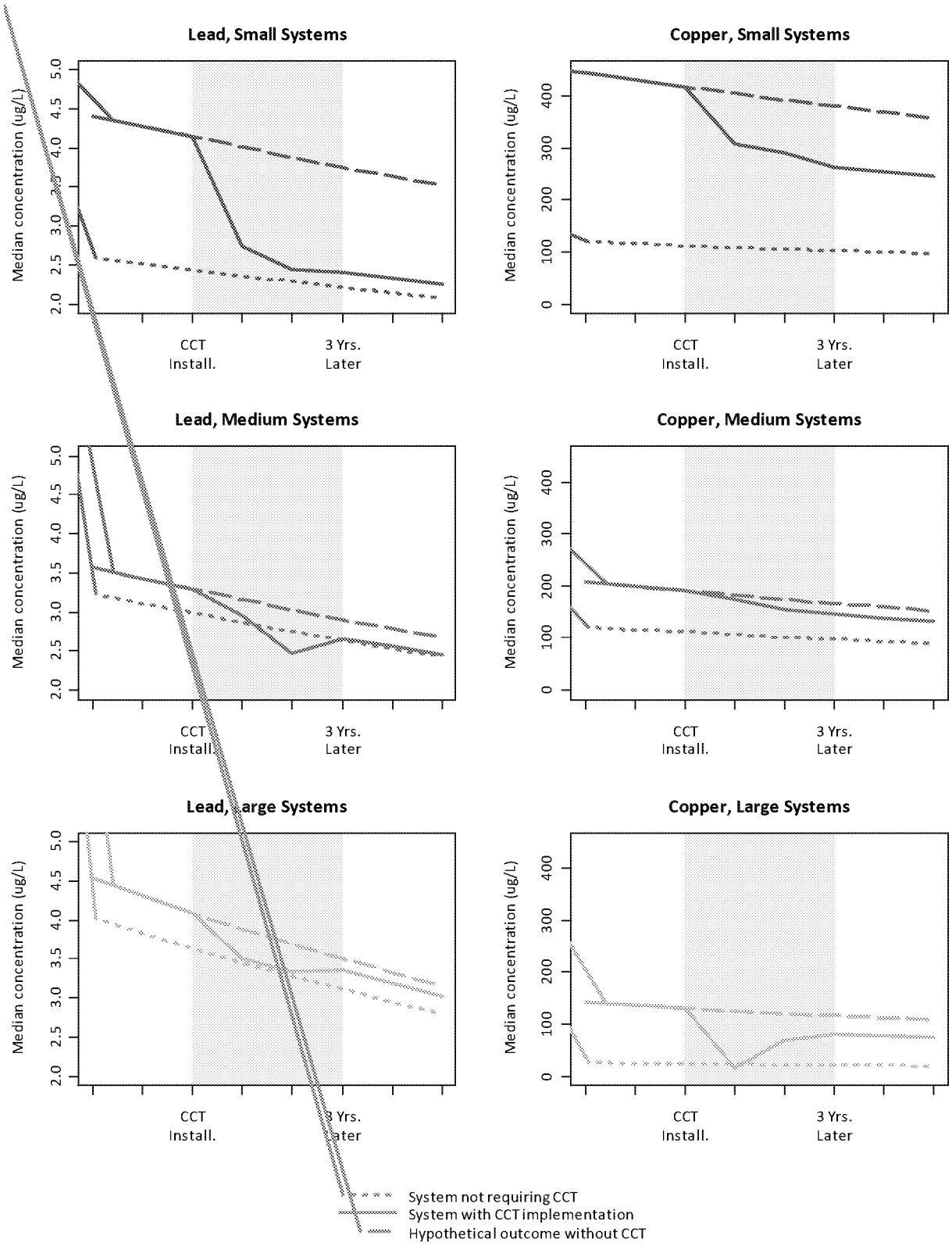


The model results presented in Exhibit III-9 assume that installing CCT produces an immediate and permanent effect on lead and copper concentrations. To explore a lagged effect of CCT, EPA estimated the effect of CCT on lead and copper levels for the first year since CCT installation, the second year since CCT installation, and the third year since CCT installation (and beyond). Exhibit III-10 displays the modeled results for SDWIS when the effect of CCT is delayed. The dotted line traces out the time path of the median lead and copper 90th percentile levels for a system that never implements CCT; such systems identify the autonomous trends in lead and copper levels that, if ignored, could confound findings on the effects of CCT on concentrations. The solid line traces out the median observed lead and copper 90th percentile levels over a system implementing CCT. The shaded region indicates the period of time that corresponds to one year, two years, and three years following CCT installation. The left border of this shaded region is the time when CCT is implemented and the right border is the time when the delayed effects of CCT have stabilized out to their permanent levels. The dashed line represents the counterfactual – what the time path of concentration would have been had CCT never been installed – it departs from the solid line at the point in time when CCT is installed. Hence, the effect of CCT is the difference between the solid line and the dashed line.

The rate of decline in median lead 90th percentile levels for systems without CCT is similar across all system size categories. The same pattern holds true for median 90th percentile copper levels. For systems with CCT, the model showed a statistically significant decline in median 90th percentile level as a result of CCT, across system size categories for both lead and copper. The magnitude of the decline ranged from just below 10% for median copper 90th percentile levels for medium systems to more than 40% for median lead 90th percentile levels for small water systems. However, for medium and large systems, there appears to be an overshooting effect: CCT initially produces a dramatic drop within the first year or two following CCT installation but then rebounds to a higher level that is still lower than the counterfactual level. Rather than indicating an actual rebound in lead and copper levels, these trends could reflect systems switching to reduced monitoring. The minimum number of required samples for systems serving 101 or more people that are on reduced monitoring is half of the required number for those on standard monitoring. In some instances, States may have required water systems on reduced monitoring to use sampling sites that historically yielded higher lead results to help ensure the continued optimization of corrosion control.

It is noteworthy that large systems have the lowest median copper 90th percentile levels and small systems have significantly higher median copper 90th percentile levels, while this same relationship between system size and concentration does not hold for lead. The reason for this pattern is unknown.

Exhibit III-10. Modeled Effect over Time of CCT Operations on Median Lead and Copper 90th Percentile Levels for each Size Category



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Conclusions

Based on its review of lead and copper 90th percentile values, milestone, violation, and treatment data reported to SDWIS/Fed (1992-2008) and lead and copper sample results voluntary reported to EPA as part of the Six-Year Review process (1998-2005), EPA observed an overall decline in lead and copper levels during 1992 through 2008. EPA conducted modeling to assess whether this decline could be attributed to CCT and whether the length of time that CCT had been in place influenced the observed lead and copper levels.

Approximately 10% of small water systems and 30 % of medium water systems are required to install CCT compared to about 93% of large systems water systems that are required to install CCT. Less than 1% of small and medium water systems and no large water systems have unresolved CCT violations.

The largest percentage of lead and copper action level exceedances occurred during the first year of monitoring for all system sizes. A greater percentage of large water systems exceeded the lead (17%) and copper (5%) action levels during initial monitoring than medium (8% for lead; 4.5% for copper) or small water systems (5% for lead; just under 4% for copper). The higher percentages observed for the large water systems may be attributed to better reporting for these water systems, which may be partly in response to an EPA press release that identified large water systems that had exceeded the lead action level based on their initial 1992 monitoring data. The fact that a lower percentage of systems (overall) exceeded the copper action level than the lead action level, during initial monitoring, may be due in part to the current tiering criteria, which targets the sampling locations that are expected to yield the highest lead results.

Based on its analysis, EPA concluded that some of the decreases in these levels occur in systems without CCT. Possible reasons for this autonomous decline may include the aging of lead- and copper-bearing plumbing materials, which release lower levels of lead and copper; replacement of residential leaded plumbing materials by homeowners; replacement of lead mains and service lines by water systems during routine replacement and maintenance; and changes in monitoring locations due to homeowners dropping out of the sampling program.

To separate out this autonomously declining trend in lead and copper levels, as well as to handle a variety of data quality limitations (particularly censoring), EPA built a statistical model of lead and copper concentrations as a function of the installation date of CCT. Across system size categories for both lead and copper, the model results consistently showed a statistically significant decline in the median 90th percentile level as a result of CCT. The magnitude of the decline ranged from just below 10% for median copper 90th percentile levels for medium systems to more than 40% for median lead 90th percentile levels for small water systems.

When the model was adapted to allow for delayed responses to CCT, the effects grew over time for small systems; in contrast, medium and large systems appear to exhibit an overshooting effect: CCT initially produces a dramatic drop within the first year or two following CCT installation but then rebounds to a higher level that is still lower than the counterfactual level.

Note that the accuracy of EPA's assessment is affected by data quality (e.g., reporting of incorrect units and dates) and completeness constraints in both the SDWIS/Fed and the Six-Year Review ICR data set. Information that is required to be reported to SDWIS/Fed (90th percentile exceedance data and lead non-exceedances data for larger water systems, and violation, milestone, and treatment information) is underreported. In addition, the lack of a milestone that corresponds directly to the date of CCT installation, changes to milestone reporting requirements and related guidance, and inconsistencies within and among states' interpretation and reporting of these milestones complicated EPA's determination of when CCT was installed.

EPA found that the Six-Year Review-ICR data set, which contains lead and copper sample results that were voluntarily submitted by states, had even greater data quality issues. The majority of 90th percentile lead and copper levels reported to SDWIS/Fed had no corresponding Six-Year Review lead or copper sample data, and in several instances, the number of lead and copper sample results was less than the minimum required number of samples. However, the completeness of the Six-Year Review information improved throughout the Six-Year Review period of 1998-2003 and may account for the rise in the number of lead and copper sample results that were above the action level.

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Appendix A
Procedure for the Determining Date of Corrosion Control Treatment Installation

This appendix describes the information and approach that EPA used to approximate the date that corrosion control treatment (CCT) was installed. This date refers to the step that precedes follow-up monitoring and the designation of optimal water quality parameters (OWQPs) by the state. These steps are described in Exhibit I-3 in the main body of the report.

A. Information Used to Approximate CCT Installation Date

The date that a water system installed CCT is not explicitly reported to SDWIS/Fed. However, the following dates associated with three types of records that are reported to SDWIS/Fed can be used to help identify the date that CCT was installed.

- Date associated with the treatment code of "C" (C designates CCT).
- Date that a system returned to compliance with its CCT violation.
- Date associated with a Deem or Done milestone.

Each of these types of data and their limitations are described in more detail below.

Treatment Code

A treatment objective code of "C" indicates a water system that has installed CCT. The date associated with the treatment code of "C" indicates when the state reported the record to SDWIS/Fed but not necessarily when the treatment was installed by the water system. Thus, as described in Section B below, EPA used the earliest reported treatment date (if multiple "C" treatment records were reported) in combination with the date a system resolved its CCT violation (if applicable) or the date the state reported a Deem or Done milestone to estimate the CCT installation date.

Violations

A violation code of 58 is reported by the state for water systems that failed to meet their CCT requirements. This violation is defined as a system that fails to: have the State-designated treatment properly installed and operating in accordance with §141.82(e) of the LCR; submit a certification of proper installation and operation in accordance with §141.90(c)(4), or demonstrate

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that OCCT already exists in accordance with §§141.81(b)(1)-(3) and 141.90(c)(1) (from Appendix B – LCRMR Reporting Guidance, October 2001).[15]

All violations have a compliance period begin and end date. According to the October 2001 LCRMR reporting guidance, the begin date of the violation is the day after the system failed to meet its CCT installation requirements. The end date (ComplPerEndDate) is defaulted to December 31, 2025. When a system returns to compliance, the 2025 date is replaced with a reported compliance period end date that marks the end of the violation.

For purposes of EPA's analysis, if the reported *ComplPerEndDate* of the CCT violation was greater than June 30, 2009 (the date the data were downloaded from SDWIS), the violation was considered to be unresolved and was used as an indicator that CCT may not have been installed. If there were multiple "resolved" CCT violations on record for the system, only the one with the earliest reported *ComplPerEndDate* was considered for determining the date of CCT installation.

Milestones

Deem and Done Milestone Description

Three milestones, Deem, Done, and LSLR are used to indicate the initiation or completion of key requirements of the LCR.[16] **"Deem"** represents the basis for the State's determination that a system is "deemed" to be optimized under the LCR. Three reason codes are to be reported with this milestone to explain how a system is deemed.

[15] A 58 violation is also used to identify water systems that are in violation with the source water treatment installation requirements. However, very few water systems have high lead and copper source water levels and are required to install source water treatment.

[16] The 2000 Revisions to the LCR revised the milestone reporting requirements (11 milestones were reduced to 2 new milestones of "Deem" and "Done", and one existing milestone that indicated systems required to begin lead service line replacement (milestone LSLR was retained)). The Done milestone replaced: OTIN – system installed CCT; STIN – system installed source water treatment; MPLS – state set maximum permissible levels (MPLs) for source water; OWQP – state set OWQPs.

Exhibit A-1: Milestone Reason Codes	
Reason Code	To Be Reported When:
B1	A PWS serves ≤ 50,000 and is at or below both action levels for 2 consecutive, 6-month monitoring periods (i.e., meets the criteria specified in §141.81(b)(1) of the LCR, also known as a B1 system).
WQP	• A PWS has installed CCT prior to the December 7, 1992 (i.e., meets the criteria specified in §141.81(b)(2) of the LCR, also known as a B2 system); or • The State has designated optimal water quality parameters (OWQPs) that define how CCT must be operated.
B3	A PWS that serves > 50,000 people and has minimal levels of corrosion in its distribution systems (i.e., meets the criteria specified in §141.81(b)(3) of the LCR, also known as a B3 system).
Note: A system can meet the B1 or B3 criteria without physically installing corrosion control treatment. Source: Based on EPA's October 2001 guidance, Appendix B - LCRMR Reporting Guidance.	

"Done" indicates when a water system has completed all required steps to reduce lead and/or copper levels, which include:

- The date the state designates OWQPs, or deems the system to have optimized corrosion control according to §141.81(b)(1) or (b)(3) [corresponds to reason codes B1 and B3, respectively];
- For systems triggered into source water treatment, the date the state designates maximum permissible source water levels or determines that source water treatment is not required; or
- For systems triggered into lead service line replacement, the date the system completes lead service line replacement or becomes eligible to cease lead service line replacement because the system is below the lead action level for two consecutive monitoring periods.

The Done milestone date to be reported corresponds to the latest event that the system was required to complete. Note that in the October 2001 Lead and Copper Rule Minor Revisions (LCRMR) reporting guidance, reason codes were not be reported with the Done milestone. However, the September 2007, Minimum Reporting Requirements for the Safe Drinking Water Information System (SDWIS/FED) indicates that these codes may be optionally reported for the Done milestone.

The following milestones indicate the systems that have installed CCT:

- Deem milestone with a reason code of WQP (hereafter referred to as Deem-WQP).
- Done milestone with a reason code of WQP (hereafter referred to as Done-WQP).

- Done milestone without a reason code (hereafter referred to as Done-no reason code) if a treatment code of "C" has also been reported and the Done milestone date does not correspond to the date reported for a Deem milestone with a reason code of B1 or B3.

The date that a system installed CCT can be approximated from the date that a Deem-WQP, Done-WQP, or Done-no reason code milestone is reported. A date of 1992 or earlier indicates that the system installed treatment prior to the rule. Thus, all sample results were collected after CCT. A date after 1992 indicates a water system that did not have CCT in place prior to the rule and should indicate the date that the state set OWQPs. As described in Exhibit I-3, after a water system installs CCT, it is required to conduct follow-up monitoring during two consecutive six-month monitoring periods. The state then has six months to set the OWQPs. Thus, the setting of OWQPs should occur approximately 18 months after the system installs CCT. The approximate date of CCT installation would be the Deem-WQP, Done-WQP, or Done-no reason code milestone date minus 18 months.

"LSLR" identifies those water systems that are required to replace lead service lines and the date replacement is to begin. This milestone was not used to estimate the date of CCT installation.

Factors that Complicate the Use of Deem and Done Milestone Dates

There are several factors that complicate using the Deem and Done milestones to identify the date of CCT installation as follows:

- Some states do not report milestones to SDWIS/Fed, report them sporadically, or report them incorrectly (e.g., incorrect date, use of reason code of B1 for large systems). See Exhibit A-2 for the number and type of milestone records that were reported to SDWIS/Fed.

- Reason codes have been reported for some Done milestones, in many other instances, Done is reported without a reason code. This may be due inconsistencies between the October 2001 Lead and Copper Rule Minor Revisions (LCRMR) reporting guidance and more current guidance (refer to the bullet below). Also see Exhibit A-2.

- The guidance issued since the October 2001 LCRMR reporting guidance has changed regarding the reporting requirements for the Done and Deem milestone. For example, the September 2007, Minimum Reporting Requirements for the Safe Drinking Water Information System (SDWIS/FED):

  - Indicate that the reason codes (see Exhibit A-1) can be optionally reported for the Done milestone. In the October 2001 guidance, reason codes were to be reported for the

Deem milestone only. Because these codes were developed to define the Deem milestone, they are not a "perfect fit" for reasons a system meets the Done milestone definition. Specifically, there are no reasons codes to indicate the installation of source water treatment or the fulfillment of lead service line replacement requirements. Note that the milestone of LSLR does not identify water systems that have completed the lead service line requirements but instead indicates when a water system is required to initiate LSL replacement.

- Redefines Deem as "System deemed optimized w/o OCCT [optimal corrosion control treatment]" and Done as "System done with OCCT. The revised Deem definition conflicts with the reason code of WQP, which is to be reported for water systems with CCT.

- Redefines the reason codes as "**B1** Serving fewer than 50,000; met action levels"; "**B3** Serving greater than 50,000; met action levels"; and "**WQP** Water Quality Parameters".

- More than one Done or Deem milestone can be reported because the status of a water system can change (e.g., the system no longer qualifies as a B1 or B3 system, or is no longer in compliance with its OWQPs).

- The same date should be reported for the Done and Deem milestone but instead the dates vary by a few days. For example, a water system serving 50,000 or fewer people was at or below both action levels for two consecutive six-month monitoring periods. This water system met the Deem-B1 criteria and also met the Done criteria because they were considered to be optimized. The dates for the two milestones should have been the same but instead, the state reported a Deem-B1 milestone on 12/31/1996 and a Done-no reason code milestone on 1/1/1997.

- For systems that met the Done or Deem criteria prior to the effective date of the 2000 Revisions of April 11, 2000, the state had the option of reporting April 11, 2000 in lieu of the actual date.

Exhibit A-2 indicates the number of milestone and reason codes that were reported to SDWIS/Fed.

Exhibit A-2. Milestone Reporting Tally		
Event	**Reason Code**	**Number of Systems**
DEEM Milestone[1]		
DEEM	B1	32381
DEEM	B3	198
DEEM	WQP	623[2]
DONE Milestone		
DONE	(None Reported)	9600
DONE	B1	13786
DONE	B3	137
DONE	WQP	389
LSLR[3]	N/A	76

[1] 40 States reported one or more Deem milestones *(Never reported by AL, CA, CO, DE, FL, HI, MS, MT, NC, NJ, NM, NV, UT, WA, WY).*
[2] DEEM-WQP was reported by 14 states/entities: EPA Region 5, ID, IL, IN, MA, MD, MI, MN, OH, PA, TN, VA, VT, WI. 55 of the 623 systems reporting DEEM-WQP list their EventActualDate as 4/11/2000. Of those, 52 are from IL, and 3 are from VA.
[3]Reported by DC, IA, IL, MA, MI, MN, MT, OH, PA, RI, VA, WI.

In response to these data considerations, EPA made the following decisions related to the use of milestone data (also refer to Section B below):

- If both a Deem-WQP and Done-WQP milestone are reported and the dates are different, the Deem-WQP milestone date is used to estimate the CCT date. The rationale for this decision is that the reason codes were developed to describe the Deem-milestone (see discussion above) and thus, there is more confidence that Deem-WQP denotes the date the state sets OWQPs as opposed to the Done-WQP.

- If the same milestone and reason code were reported for the same water system, use the earliest date to establish the CCT installation date.

- For systems with a Done-WQP, Deem-WQP, or Done-no reason code date (for systems with a treatment code of "C") of April 11, 2000, subtract out 18 months to account for follow-up monitoring and the State designation of OWQPs. Use the October 1998 date as the CCT installation date unless the system has an early treatment date or resolved CCT violation date. Note that the October 1998 date could potentially be later than the true CCT date by about 1 to 2 years for a small or medium system that exceeded an action level during the first round of monitoring, if the system followed the scheduled as outlined in section 141.81, and both the state and system used the maximum time allotted for a particular step, e.g., 18 months for a study.

B. Approach for Determining CCT Installation Date

For each drinking water system analyzed, a determination was made as to whether the system installed CCT, and if so, when the system installed treatment. The determination was made on the basis of a branching series of Yes/No questions using treatment, milestone, and CCT violation data (type 58 violation) that was reported to SDWIS/Fed. This logical process is represented below as two flow charts (one flow chart for Small and Medium systems and a second for Large systems). A textual description of this logic tree follows.

CCT Date Assignment for Small and Medium Systems

1. If the system reported a treatment code of "C" (code signifies CCT), assume the system installed treatment on or before the treatment date.[17] Attempt to acquire a more precise date by considering the system's history of milestones and violations. However, ***assign CCT to the treatment date*** if the following steps suggest a later date:

    a. If the system reports an end for a CCT violation, assign CCT to the violation end date.

    > **Example:** If the reported treatment date is 2/1/96 and the reported compliance period end date for the CCT violation is 3/21/97, the system would be considered to have installed CCT in Feb 1996. Conversely, if the CCT violation date preceded the treatment date, the treatment date would be used as the CCT installation date.

    b. Otherwise, if the system reports a "DEEM" milestone with reason "WQP", assign CCT to the date of the milestone[18] minus 18 months.

    c. Otherwise, if the system reports a "DONE" milestone with reason "WQP", assign CCT to the date of the milestone minus 18 months.

    d. Otherwise, if the system reports a "DONE" milestone with no associated reason and if a milestone with reason "B1" is not reported within one month before or after the "DONE" milestone, assign CCT to the date of the milestone. In this case, subtact 18 months only if the milestone comes after December 7, 1992.

[17] The "treatment date" is the *FirstReportedDate* for a record with treatment code "C". If there are multiple records, only the one with the earliest *FirstReportedDate* is considered. Note the *FirstReportedDate* is only meant to mark the date the treatment was recorded in SDWIS and may be well after date treatment actually occurred.

[18] The date of the milestone is the *EventActualDate* reported in the SDWIS Events table. If the multiple milestones with the same event code and reason code are reported, only the one with the earliest *EventActualDate* is considered.

Example: The state reported the following milestones for a water system:

- Deem milestone with a reason code of B1 on 12/31/96.
- Done milestone with no reason code on 1/1/97.
- Done milestone with no reason code on 1/1/04.

The state also reports a treatment code of "C" on 3/1/05. No CCT violations have been reported for the system. Because the Deem and 1st Done milestone differ by ≤ 1 month, the system is considered to have met the Done criteria because it was a B1 system.

The system has installed CCT, as indicated by the reported treatment code of 3/1/05. Thus, the 2nd Done milestone, reported on 1/1/04, is assumed to indicate the setting of OWQPs by the state. In this example, the CCT installation date is estimated to be 7/1/02 (the 2nd Done milestone date less 18 months). The reported treatment date is not used because it occurs later than the 2nd Done milestone date.

e. Otherwise, assign CCT to the treatment date.

2. If the system did not report a treatment code of "C", proceed through steps 1a, 1b, and 1c above. If the system fails to meet conditions specified in 1a, 1b, or 1c, then assume that the system did not install treatment.

CCT Date Assignment for Large Systems

1. If the system reported a treatment code of "C", proceed through steps 1a to 1d for Small/Medium systems (for step 1d, the "B1" reason code does not apply) with the stipulation that CCT be assigned to no later than the treatment date. If the system fails to meet conditions specified in 1a, 1b, 1c, or 1d, assign CCT to the treatment date or January 1, 1997, whichever is earlier.

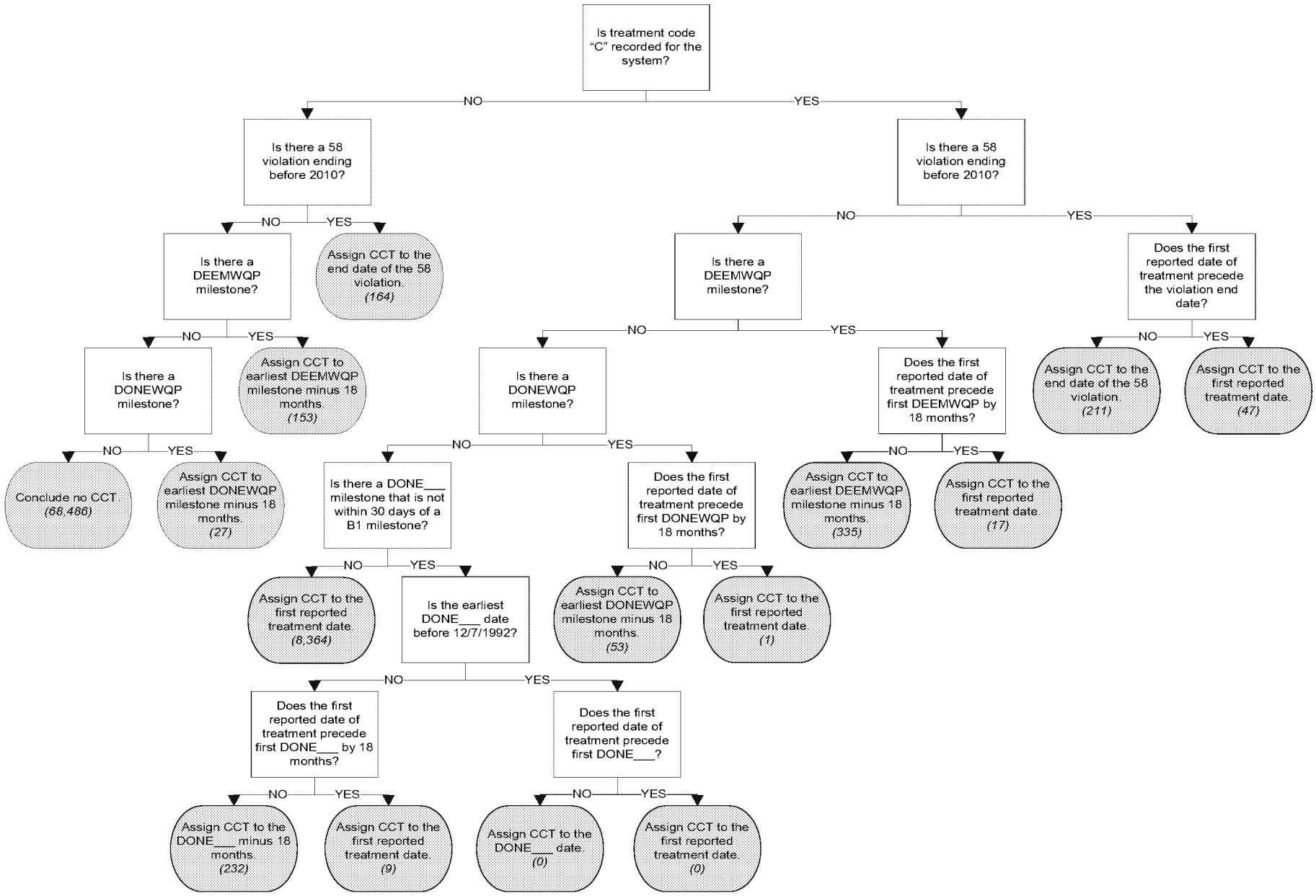
2. If the system did not report a treatment code of "C", proceed through steps 1a to 1c for Small/Medium systems. If the system fails to meet conditions specified in 1a, 1b, or 1c, then check whether the system ever reported a milestone with reason "B3". If it did, assume CCT was not installed. Otherwise, check whether the system has an open CCT violation.[19] If it does, assume CCT was not installed. Otherwise, assign CCT to January 1, 1997.

For both Small/Medium and Large systems, if CCT was assigned to January 2009 or later, then the system is treated as if it never installed treatment because it is outside the period of review considered for this white paper (i.e., December 31, 2008).

[19] If a CCT violation record has a *ComplPerEndDate* greater than June 30, 2009, the system is assumed to have an open violation. If there are multiple CCT violations on record for the system, only the one with the latest *ComplPerEndDate* is considered when determining whether a violation is open.

Logic for Determining CCT Installation Date for Medium and Small Water Systems (serve 25-50,000 people)

(The number is parentheses indicates the number of water systems that met the criteria)



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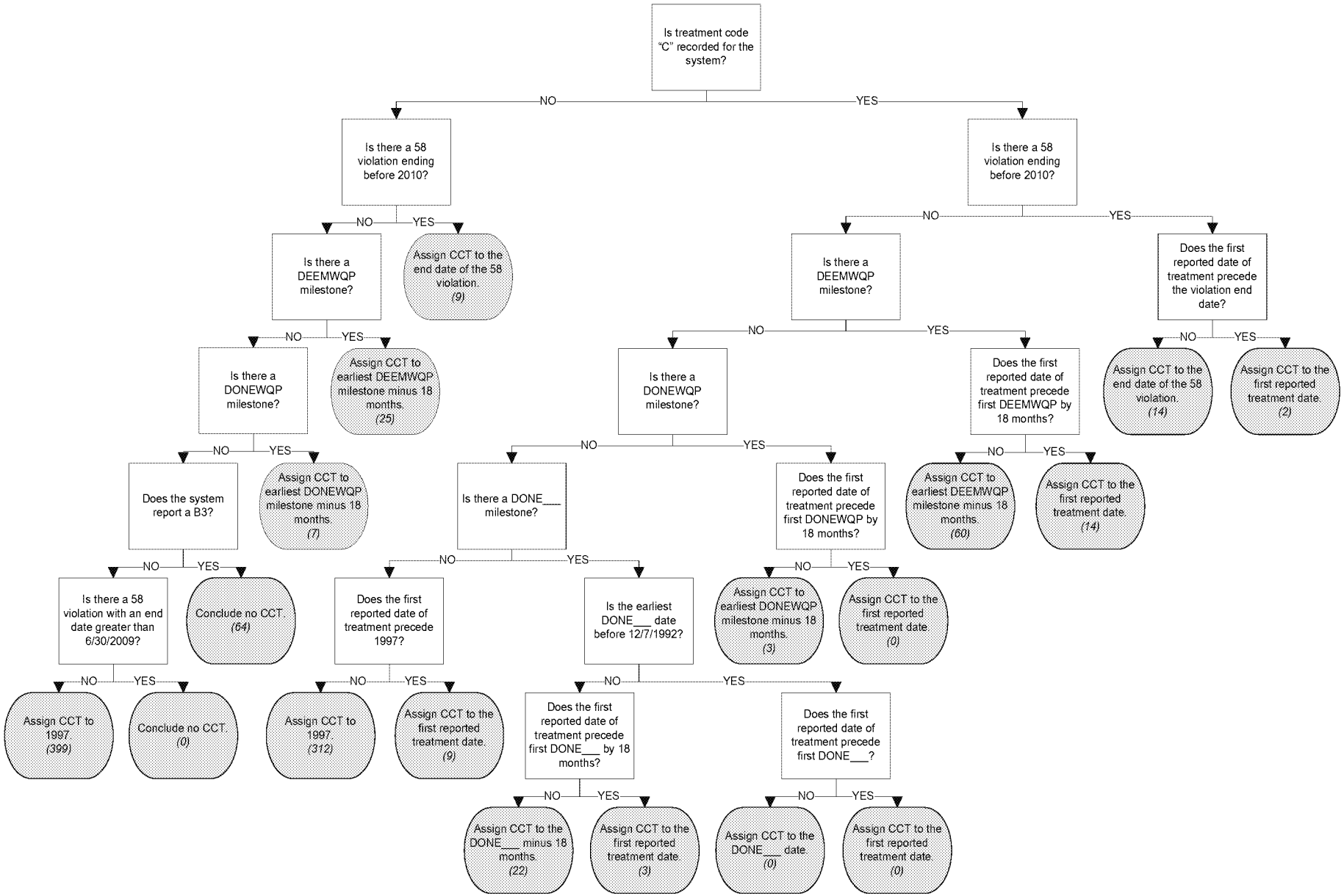
Logic for Determining CCT Installation Date for Large Water Systems (serve >50,000 people)

(The number is parentheses indicates the number of water systems that met the criteria)



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Appendix B
Description of the Quality Assurance Review for the Six-Year Review-ICR Dataset

The bulleted text below outlines that steps that EPA undertook to assess the quality of lead and copper sample results that were submitted in response to the Six-Year Review ICR.

- Samples with lead values reported as <0.00006 mg/L and copper values reported as <0.00005 mg/L (i.e., the method detection limit divided by 10) were screened from the Six-Year-ICR dataset.

- Potential problem high lead concentration results or "outliers" in 34 States were identified. Potential copper "outliers" were identified in 27 States. These outliers were defined as any concentration result greater than 10 times the action level (0.15 mg/L or 150 ppb for lead and 13 mg/L or 13,000 ppb for copper).

- Steps taken to review the data included:
  - All copper concentrations that were greater than 10 times the action level (13 mg/L) were reviewed.
  - All lead concentrations greater than 100 times the action level (1.5 mg/L or 1,500 ppb) were reviewed on a case-by-case basis.
  - The remaining high lead results were reviewed on a global basis (vs. case-by-case).
  - When available, the text version of the analytical record was also reviewed against the numerical version to help identify data entry errors.
  - The reported unit of measure was also compared to other units reported by the PWS.
  - For all copper "outliers" and several lead outliers, the 90th percentile level reported to SDWIS/Fed was compared against the "calculated" 90th percentile in the Six-Year Review-ICR dataset to help determine if a sample was reported in the incorrect units or had a decimal placement error.

- The concentration value was converted (i.e., moved the decimal place to the correct location) if there was strong evidence that the result was a units error. For example, SDWIS/State (the database used by 30 states providing Six-Year data) includes a column of data that lists the concentration value saved as text. This is done to maintain all the leading and trailing zeroes. For instance, for a result that was in the 'text result' column as "0051" but was in the 'numerical result' column as 51 mg/L (and all other results were <=0.05 mg/L), that was strong enough evidence to determine that this was a unit error and this result should be 0.051 mg/L rather than 51 mg/L.

- The concentration value was converted to the correct units if the sample was in different units than the rest of the lead samples from the system and it appeared as if there was a data entry error in the units.

- The concentration value was excluded from the analyses if the sample was marked as an entry point (EP) sample (because this would be indicative of a source vs. tap sample), rather than a distribution system (DS) sample) and it was from a state that distinguishes between EP and DS results and there were other DS samples reported for the PWS.

  Note that the Six-Year Review ICR requested that the sample analysis type indicate whether a sample was "tap" or "source". Only 2 states (of 43 states for lead and of 41 states for copper) used this naming convention. The remainder tended to identify their samples as DS or EP but most states did not use these designations consistently. Thus, the analyses will include some source water sampling data; however, the exact number of samples is unknown. Approximately 7% - 8% of samples in the dataset are identified as EP.

- Most incorrectly reported sample monitoring results were results of data entry or coding error in the State database.

- If there was not strong evidence to either convert or exclude the high result from the analyses, the result was included in the analyses.

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Appendix C
Statistical Model of Lead and Copper Concentrations as a Function of Date of CCT Installation

In estimating the effect of CCT installation on lead and copper levels, EPA was confronted with several challenges:

- Only a subset of 90th percentile lead and copper data is required to be reported to SDWIS/Fed (i.e., all lead and copper 90th percentile exceedances and lead 90th percentile levels for large water systems (and for medium water systems after 2000).

- Many of the Six-Year Review sample values are below the method detection limit, which would bias the data if handled improperly (e.g., by excluding these values or assigning them to an arbitrary point between 0 and the MDL).

To overcome these challenges, EPA built a parametric statistical model that allows the effect of CCT installation to be estimated. The model is a member of the "mixed effects" family of parametric models. The model makes the following assumptions:

- Each system has a (long-run) mean concentration of lead and a mean for copper.
- These baseline lead and copper levels are log normally distributed across systems.
- Within a system, contemporaneous variation in concentration around the mean is distributed log normally.
- Across systems, the baseline log concentrations follow a common linear trend.
- The mean baseline for systems that install CCT is different from the mean baseline for systems that do not install CCT.
- The installation of CCT produces a permanent shift in the mean of the log concentration; this treatment effect can differ for copper and lead but is invariant across systems in the same size category.

Given these assumptions, the log of concentration at time t is normally distributed with a mean that is a linear function of model parameters:

$$pdf(\ln y_{it} \,|\alpha_i, CCT, t) = \phi\left(\ln y_{it}\,; \alpha_i + \beta t + \delta 1\{C_i \leq t\}, \sigma_y^2\right)$$

Where:

i = index identifying system

t = index identifying time period (year)

pdf = probability density function

ϕ = normal probability density function

ln y_{it} = log concentration for system i at time t

α_i = (long run) mean of log concentration for system i

β = autonomous rate of change of concentration (slope of trend)

δ = effect of CCT on concentration

1{} = indicator function equal to 1 if its argument is true

C_i = the date that system i installed CCT (set to an arbitrary number above T, the latest date in the sample, if the system did not install CCT during the time observed)

σ_y = standard deviation of the variability of concentration around a system's long-run mean.

Likewise, the distribution across systems of the (long-run) mean is given by:

$$pdf(\alpha_i, CCT) = \phi(\alpha_i; \mu + \gamma 1\{C_{it} \leq T\}, \sigma_\alpha^2)$$

Where:

μ = mean of distribution of systems' (long-run) log concentration means

γ = mean difference between systems that install CCT (at some point) verses those that do not

σ_α = standard deviation of the variability of (long-run) means across systems.

Putting these two pieces together, the basic likelihood of the data given the model parameters is:

$$pdf(\ln y_{it} \,|CCT, t) = \int_{-\infty}^{\infty} \begin{matrix} \phi\left(\ln y_{it}\,; \alpha_i + \beta t + \delta 1\{C_i \leq t\}, \sigma_y^2\right) \times \\ \phi(\alpha_i; \mu + \gamma 1\{C_i \leq T\}, \sigma_\alpha^2) \end{matrix} d\alpha_i$$

This is the likelihood when a level is observed in the data. When the concentration could not be detected, then all that one knows from the data is that the actual level was beneath the minimum detectable limit. Hence, the analyst can aggregate all of the likelihood up to that point to produce the probability of observing a non-detect:[20]

$$Pr(\ln y_{it} \leq MDL|CCT, t) = \int_{-\infty}^{MDL} pdf(\ln y_{it} \,|CCT, t)\, d \ln y_{it}$$

For copper 90th percentile data reported to SDWIS/Fed, where there was not a reporting requirement for concentrations at or below the action level, the censoring point is action level (1.3

[20] For the Six-Year Review lead and copper sample results, the detection limit is usually reported. When the detection limit was not reported, a substitute was used according to the standard procedures for Six-Year Review data. For 90th percentile values reported to SDWIS/Fed, no detection limits are reported for non-detects (when the reported Sample Measure equals zero, the value is considered to be a non-detect). To deal with this shortcoming, EPA used the 5th percentile SDWIS lead detect value as the detection limit for all SDWIS lead non-detects.

mg/L) not the MDL. Lead and copper results are analyzed together; therefore, EPA assumed that every lead entry in SDWIS/Fed had a corresponding copper 90th percentile reading (only copper 90th percentile exceedances are reported to SDWIS/Fed).

EPA handled outliers with an analogous censoring procedure. When the level was so extremely high as to make it implausible, EPA assumed that the data entry was a miscode and censored that observation. EPA assumed that these top-codings censor values exceeding 1.5 mg/L for lead and 13 mg/L for copper.

To estimate the model parameters, identified above, EPA searched for the parameter values that maximize the likelihood of observing the actual data. Because all of the model's parameters vary across size categories and data source (i.e., SDWIS/Fed and Six-Year Review), this estimation was performed 12 times to cover each case: SDWIS lead, SDWIS copper, Six-Year lead, and Six-Year copper each separately for small, medium, and large systems.

Message

From: Tracy Mehan [tmehan@awwa.org]
Sent: 5/23/2016 3:20:31 PM
To: Grevatt, Peter [Grevatt.Peter@epa.gov]
Subject: RE: ACE Q&A

Thanks, Peter. I will finalize all the questions I/we have and send them back to you.

Also, can you forward a bio when you get the chance.

FYI, I am in the office this week but out of the country from May 31st through June 8th. Back in the office June 9th.

Tracy

From: Grevatt, Peter [mailto:Grevatt.Peter@epa.gov]
Sent: Sunday, May 22, 2016 4:54 PM
To: Tracy Mehan <tmehan@awwa.org>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: ACE Q&A

Tracy, here are some additional questions that could work for ACE, depending on the interest of the audience. I realized over the weekend that I was in error when I sent you my schedule for breakfast this week. Wednesday is the only day that works for me and I think that was out for you. I'll be tied up all day on Thursday and I have a very long travel day tomorrow with a round-trip to Denver. I might be able to do something in the afternoon on Tuesday. Please feel free to work with Paula to see whether there is a time we can work out. Thanks, P.G.

Lead and Copper

- What do you view as the most important lessons from Flint for the water sector?
- How do you see that the experience in Flint has impacted the public confidence in the safety of drinking water? How do you believe we should address those issues?
- Has Flint changed the regulatory outlook for EPA on lead or other issues?
- What are your thoughts on the effectiveness of the LCR? How can it be improved?

Health advisories

- When does EPA choose to issue a health advisory versus and MCL/G? Is one more protective than the other?

Technology and Innovation

- What do you believe are some of the advances in technology that will improve the water sector? Challenges?

Looking Forward

- What do you believe the water sector can do to increase transparency and public awareness?

Closing

- What should every citizens know about their drinking water?

From: Tracy Mehan [mailto:tmehan@awwa.org]
Sent: Thursday, May 19, 2016 4:45 PM

To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Cc: Patricia Chism <pchism@awwa.org>
Subject: RE: ACE Q&A

Peter,

You can also just send me a few questions you would like me to ask.

That said, I could do breakfast either Tuesday or Thursday next week.

Thanks.

Tracy

From: Grevatt, Peter [mailto:Grevatt.Peter@epa.gov]
Sent: Thursday, May 19, 2016 4:33 PM
To: Tracy Mehan <tmehan@awwa.org>
Subject: RE: ACE Q&A

Sounds good Tracy. I'm now doing a day trip to Denver on Monday (!) so I can be back for a meeting I need to attend here in DC on Tuesday. We have the first of our 3 stakeholder forum meetings on Thursday. Wednesday might be ideal for coffee or possibly breakfast. Please let me know what works best for you. Thanks, P.G.

From: Tracy Mehan [mailto:tmehan@awwa.org]
Sent: Thursday, May 19, 2016 4:24 PM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Subject: ACE Q&A

Peter,

I am starting to compile a list of questions for our session at ACE. I will be happy to share them with you when I have worked them over a bit. If you have any you want to add, I could compile them into one document to discuss with you. Maybe something next week? Thanks.

Tracy

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Message

From: Goodmann, Peter (EEC) [Peter.Goodmann@ky.gov]
Sent: 3/22/2018 11:52:54 PM
To: J. Alan Roberson [aroberson@asdwa.org]; Grevatt, Peter [Grevatt.Peter@epa.gov]
Subject: Fwd: Power Point Presentation on Kentucky Lead Group
Attachments: Lead WG Rec - KY Water Law Seminar 3-26-18.pptx; ATT00001.htm

Maybe the ppt will be attached this time.

Sent from my iPhone

Begin forwarded message:

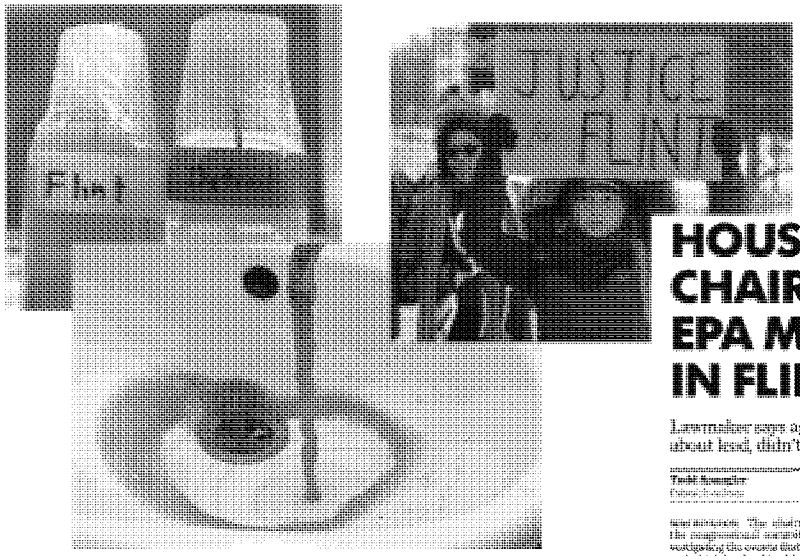
> **From:** Gregory Heitzman <Gheitzman@bluewaterky.com>
> **Date:** March 21, 2018 at 10:05:48 PM EDT
> **To:** "Wuetcher, Gerald" <Gerald.Wuetcher@skofirm.com>
> **Cc:** "Talley, Damon" <Damon.Talley@skofirm.com>, Gregory Heitzman <Gheitzman@bluewaterky.com>, Tom Gabbard <Tom.Gabbard@ky.gov>, "peter.goodmann@ky.gov" <peter.goodmann@ky.gov>
> **Subject: Re: Power Point Presentation on Kentucky Lead Group**
>
> Jerry, Here is the 3/26 ppt file for Tom. Pls confirm you receive the file.

Kentucky Lead Workgroup Findings, Best Practices and Recommendations

Water Law Seminar

Tm Gabbard, Greg Heitzman
Kentucky Lead Workgroup
March 26, 2018
Northern Kentucky

Flint Public Health Crisis



HOUSE PANEL CHAIR ASSAILS EPA MISSTEPS IN FLINT CRISIS

Lawmaker says agency ignored warnings about lead, didn't act on information

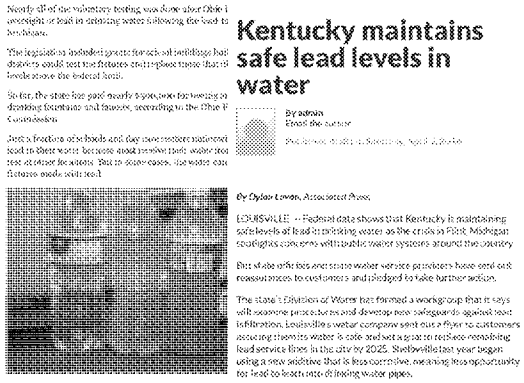
[illegible] The chairman of the congressional committee investigating the events that result-

considering that he brought the problem to light months before the EPA finally enacted an emergency order in Flint in January of this year, Del Toral should have been given a pay raise.

In an email released by the

ED_005190_00001578-00002

Trouble Spreading



Kentucky Lead Workgroup Members

- Jennifer Burt, Kentucky Health Department
- Obe Cox, Carroll County Water District
- Tom Gabbard, Kentucky Division of Water
- Mike Gardner, Bowling Green Municipal Utilities
- Greg Heitzman, BlueWater Kentucky
- Ron Lovan, Northern Kentucky Water District
- Brad Montgomery, GRW Engineers
- Bill Robertson, Paducah Water
- Tom Rockaway, PhD, University of Louisville
- Justin Sensabaugh, Kentucky American Water Company
- Rengao Song, PhD, Louisville Water Company
- Brian Thomas, Marion Water Department

Kentucky Lead Workgroup Resources

- Peter Goodmann, KY Division of Water
- Claude Carothers, KY Division of Water
- Samantha Kaiser, KY Division of Water
- Susan Lancho, Kentucky American Water
- Gary Larimore, Kentucky Rural Water
- Kay Sanborn, KY-TN AWWA
- Kelley Dearing Smith, Louisville Water Company
- Victoria Wilhoite, KY Division of Compliance Assistance

Kentucky Lead Workgroup

- First meeting held April 20, 2016
- Workgroup generally meets monthly on third Wednesday
- Meetings open to the public
- Sub-teams established in the following areas:
  - ✓Public health
  - ✓Lead regulations and compliance record with LCR
  - ✓Treatment/Corrosion control
  - ✓Distribution/Piping/Plumbing infrastructure
  - ✓Training/Education
  - ✓Financing/Funding lead replacement
  - ✓Communications/Education

Kentucky Lead Workgroup

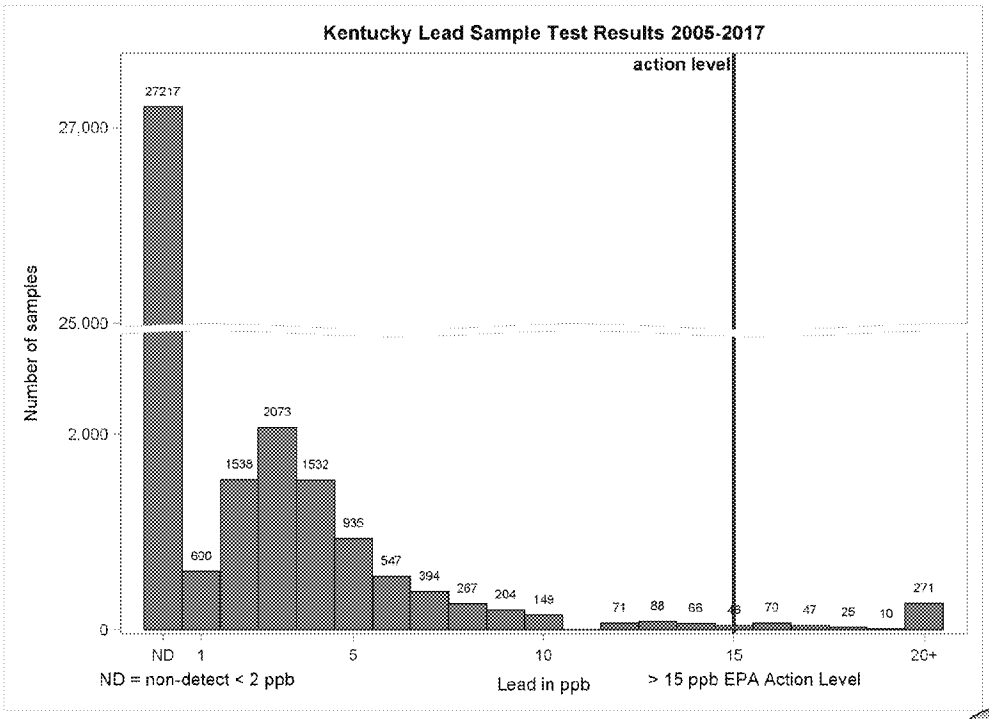
- Expect Final Report to be completed by Sumer, 2018
- Deliverables:
  - ✓ Recommendations
  - ✓ Power point presentations on each topic area
  - ✓ Workgroup, compiled by sub-team/topic area
- Workgroup report will provide the following:
  - ✓ Summary of Kentucky's compliance with EPA's Lead and Copper Rule
  - ✓ Best practices for treatment of lead in drinking water
  - ✓ Best practices for removal of lead pipes, fixtures, etc.
  - ✓ Preparation for future regulatory changes (lower action levels)
  - ✓ Best practices for sharing lead information and educating consumers
  - ✓ Financing practices to fund replacement programs
  - ✓ Recommendations to State Agencies, Utilities, and Industry Associations

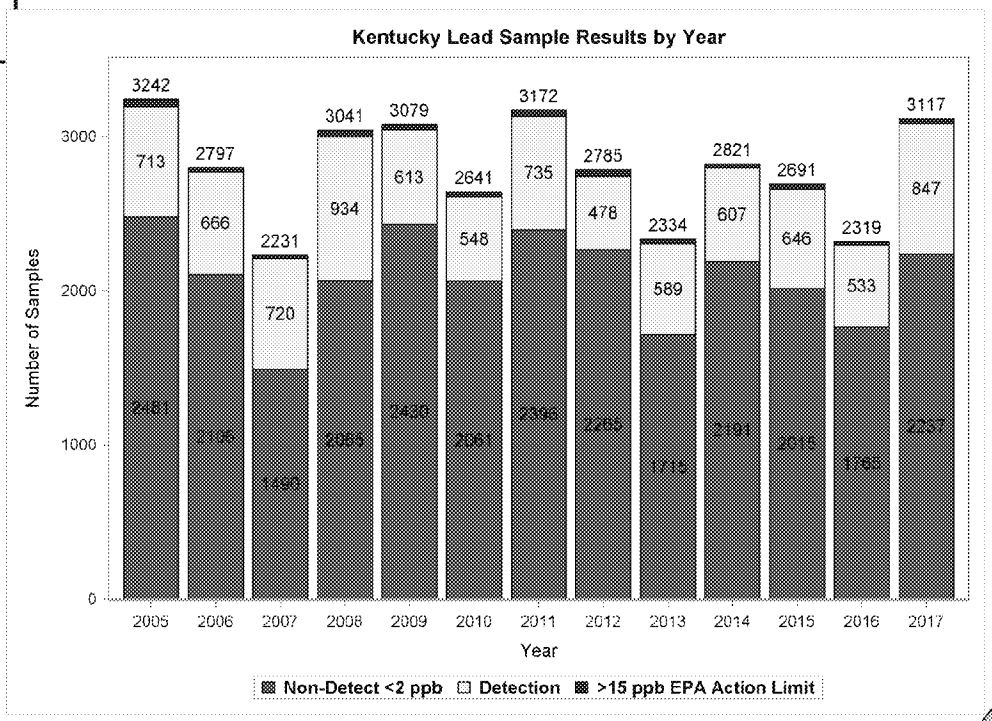
M

KY Lead Compliance Results

- 436 Public Water Supply Systems (PWS) in KY
- 390 PWS monitor for lead under the LCR
- # of samples based on population
- 36,270 Lead Compliance samples 2005-17
- 75% of samples had no detection (< 2 ppb)
- 98% of samples less than 15 ppb
- 3 systems (2%) exceeded 15 ppb
- 3 systems (<1%) required additional action
- Since 2012, all KY PWS comply with LCR

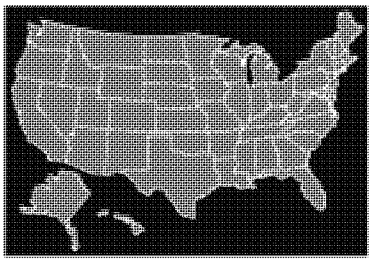
Division of Water


Kentucky Lead Sample Test Results 2005-2017
action level
Number of samples
27,000
25,000
2,000
0
27217
690
1538
2073
1532
935
547
394
267
204
149
71
88
66
46
70
47
25
10
271
ND
1
5
10
15
20+
ND = non-detect < 2 ppb
Lead in ppb
> 15 ppb EPA Action Level


Kentucky Lead Sample Results by Year
Number of Samples
0
1000
2000
3000
3242
713
2481
2797
666
2131
2231
720
1491
3041
934
2095
3079
613
2430
2641
548
2081
3172
735
2396
2785
478
2285
2334
589
1715
2821
607
2191
2691
646
2015
2319
533
1765
3117
847
2257
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year
Non-Detect <2 ppb
Detection
>15 ppb EPA Action Limit

What Have We Learned?

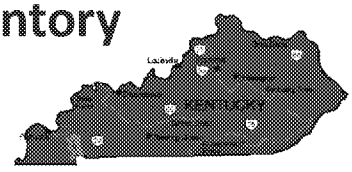
US Lead Service Line Inventory



- AWWA/EPA estimates 6.1 million public Lead Service Lines (LSL) in U.S. (range of 5.5 to 7.1 million LSL)
- Includes full and partial LSL (public and private)
- Largest density is with systems serving 10,000 to 50,000 Population.
- Generally utilities transitioned from lead to copper between 1930 and 1960
- National cost estimate of $18 to $30 billion for 6.1 million LSL, assumes $3,000 to $5,000 per LSL replacement costs

What Have We Learned?

Kentucky Lead Service Line Inventory



- AWWA/EPA estimate 53,000 Public LSL in Kentucky (we think overestimated)
- Replacement Cost Range of $1,500 to $3,000 each
- Estimate of $79.5 to $159 million for public portion
- Estimate 13,000 Private LSL in Kentucky
- Replacement Cost Range of $1,000 to $2,000
- Estimate of $19.5 to $26 million for private portion
- Total Kentucky Estimate for removal of Public and Private LSL of $92.5 to $185 million (based on AWWA/EPA estimated #s)

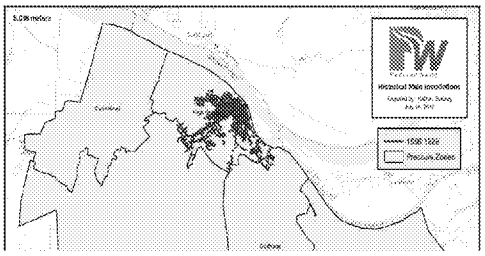
How does Kentucky Compare?

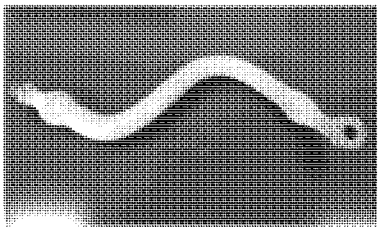
- **United States Survey Data:**
  - US 2015 Population 320 million people
  - 293 million people served by Community Water Systems (92% served)
  - 97.7 million household connections (assumes 3 people per connection)
  - 6.1 million Lead Service Lines (AWWA Journal Article June 2016)
  - Estimate 6.2% of US Houses have full or partial Lead Service Lines
- **Kentucky Survey Data:**
  - Kentucky 2015 Population of 4.4 million
  - 4.2 million people served by Community Water System (95%+ served)
  - 1.4 million household connections (assumes 3 people per connection)
  - 53,000 Lead Service Lines (AWWA Journal Article June 2016)
  - Estimate 3.8% of KY Houses have full or partial Lead Service Lines

Kentucky Compares Favorably to National Average

Best Practices Emerging

- On-line lead service GIS database
- Free water sampling for lead
- Proactive lead replacement programs (public and private)
- Lead replacement subsidy or finance program for homeowner's portion of lead piping





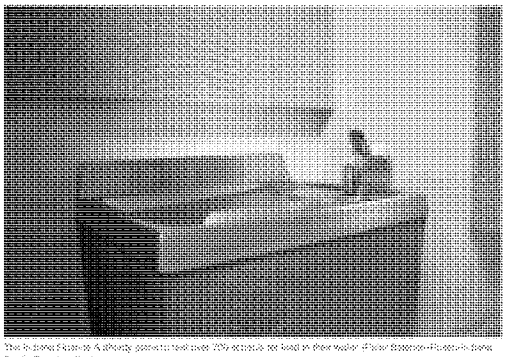
Best Practices Emerging

- Optimized water treatment for corrosion
- Best practices for sampling and monitoring
- School partnerships for lead inventory, testing, flushing and plumbing fixture replacement (Indiana Finance Authority school program)

Indiana To Begin Testing For Lead In Public School Water

MAY 30, 2017 | 4:36 PM

BY PETER SALONON-ROSER

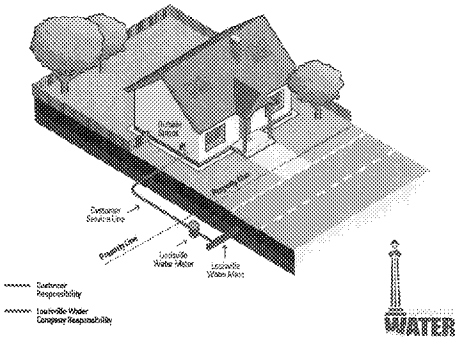


State officials plan to investigate the drinking water of over 700 Indiana public schools

Best Practices Emerging

- Lead education and communication materials
- Best Practices for Flushing

Typical Water Service Line



M

Regulatory Possibilities

- Reduction in Action Level below 10 ppb
- Possibly a MCL for Lead or a Household Action Level
- Change in sampling methods (cycles, size, frequency, locations)
- Strict water sampling protocol for lead
- Mandatory replacement programs (XX % per year)
- Mandatory lead education materials provided to for consumers, including health risk info.
- Private lead line replacement requirements for homeowners
- Specific lead action steps for schools, daycares and public facilities

32 Recommendations of the Kentucky Lead Workgroup

State Level Recommendations (10)

1. Develop protocol, guidance and technical assistance for evaluation of treatment process changes using the US EPA's Optimal Corrosion Control Treatment (OCCT) report published March 2016. A Corrosion Control Plan (CCP) should be developed when:

   a) a new water source is introduced (including interconnects with utilities);
   b) the water source is changed;
   c) the water treatment process is changed (including chemical additives);
   d) lead compliance sampling results are near or exceed the EPA Action Level (currently 15 ppb);
   e) an interim supply is needed (excludes emergency supply)

A CCP is a complex analysis. To assure optimal water treatment quality is achieved and regulatory compliance is maintained, the CCP should be conducted by a qualified water quality professional. As recommended by EPA, the CCP should be developed in coordination with the Kentucky Division of Water.

State Level Recommendations (10)

2. Establish protocol and reporting requirements for utilities to use for the collection and reporting of special lead samples and when customers request water sample testing for lead.

3. Update the estimated number of lead service lines (public and private) in Kentucky and the associated replacement costs.

4. Revise prioritization criteria for state-wide water projects to include lead service line replacement.

5. Develop funding sources that utilities can use to finance lead service line replacement (public and private) and lead abatement projects. Funding sources may include: KIA, Rural Development, SRF funding, and state/local appropriations.

State Level Recommendations (10)

6. Develop a lead training curriculum in partnership with utilities, state and local health departments and water industry associations. The training should include corrosion control treatment methods, lead service line replacement and repair practices, flushing practices and customer communications.

7. Consider Kentucky state legislation for requiring blood lead level testing for all children at 12 and 24 months of age.

8. Update the Kentucky Division of Water's website to serve as a resource for information on lead in drinking water, best practices, health impacts and regulatory requirements.

State Level Recommendations (10)

9. Promote the use of U.S. EPA's 3T (Training, Testing and Telling) program for reducing lead in drinking water in schools and child care centers. The program includes: Training of school officials on the potential of lead in drinking water; Testing of drinking water in schools to identify potential problems and corrective actions (as needed); and Telling staff, parents, students and the local community about the testing results, potential risks and remedial actions taken by the school.

10. Monitor lead testing programs for schools and child care centers being used in other states and consider implementing in Kentucky following a review of benefits and costs.

Utility Recommendations (13)

1. Conduct a Corrosion Control Evaluation (CCE) and develop a Corrosion Control Plan (CCP) for water treatment and distribution operations following the guidance provided in US EPA's Optimal Corrosion Control Treatment (OCCT) report published March 2016. A CCP should be developed when:

   a) a new water source is introduced (including interconnects with utilities);
   b) the water source is changed;
   c) the water treatment process is changed (including chemical additives);
   d) lead compliance sample results are near or exceed the EPA Action Level (currently 15 ppb);
   e) an interim supply is needed (excludes emergency supply).

A CCP is a complex analysis. To assure optimal water treatment quality is achieved and regulatory compliance is maintained, the CCP should be conducted by a qualified water quality professional. As recommended by EPA, the CCP should be developed in coordination with the Kentucky Division of Water.

Utility Recommendations (13)

2. Adopt the EPA recommended guidelines for lead compliance sampling.
3. Prepare for a reduction in the EPA Lead Action Level from 15 parts per billion (ppb) to less than 10 ppb as part of a revised Lead and Cooper Rule (LCR).
4. Prepare for more frequent sampling cycles and more diverse sampling locations for LCR compliance.
5. Adopt a policy or practice to remove public lead service lines when exposed during excavation. Communicate the discovery of any private lead service lines to the homeowner/occupant. The communication message should define the homeowner's responsibility for private plumbing, the benefits of flushing and the impacts of lead contained in plumbing fittings and fixtures.

Utility Recommendations (13)

6. Proactively investigate the location of public lead service lines using various methods (historical records, maps, construction plans, field surveys, home age, etc.). The service line information (public portion) should be added to the water distribution inventory, maps and records (include material type, age, condition, and other attributes where available).

7. Provide customers access to an on-line database of utility-confirmed lead service line locations (public portion).

8. Adopt a long-term goal of replacing all lead service lines. The implementation practices and the time line associated with this goal will be based on local conditions and financial capability.

Utility Recommendations (13)

9. Develop consumer education materials on lead in drinking water in collaboration with industry associations, regulators and public health officials. The education materials should: include the health risks associated with lead; include guidance on common methods to reduce lead exposure; and identify the homeowner responsibility for private service lines and plumbing fixtures. The information should be provided to consumers and stakeholders through Consumer Confidence Reports, websites, social media, door hangers and other available communication methods.
10. Train field personnel to identify, locate, repair, and/or replace lead service lines and lead-containing fittings.

Utility Recommendations (13)

11. Monitor state and national best practices on managing lead in drinking water. Practical and feasible practices should be implemented where appropriate.
12. Review the ANSI/AWWA Standard C810-17 on Replacement and Flushing of Lead Service Lines (published November 1, 2017). The standard should be adopted where feasible and practical.
13. Develop a program to partner with the health department, public/private schools and childcare centers for testing, education and coordination of replacement of lead piping and plumbing fixtures within school and childcare facilities. The program should include a protocol for reporting results of lead testing to the utility, schools and child care centers, local health department and Kentucky Division of Water.

Industry Recommendations (4)

1. Develop a utility training curriculum on lead in drinking water, including: lead treatment (corrosion control); water sampling protocol; system assessment for lead; lead inventory; lead service line repair; lead service line replacement (public and private); the potential source of lead from homeowner plumbing fixtures; and communication materials for consumers.

2. Identify key stakeholders and develop lead communication tools, including web site links and templates, for utilities to use in communicating with customers. Utilize existing resources from national and local partners. The materials should include information on the homeowner responsibility for private lead service lines and plumbing fixtures that may be sources of lead.

Industry Recommendations (4)

3. Engage and educate key stakeholders on lead in drinking water. Key stakeholders include health departments, medical professionals, regulatory agencies, education officials, engineering professionals, building trades, homeowners and other organizations that are impacted by or establish policy or regulations regarding lead in drinking water.

4. Pursue financial assistance from local, state and federal agencies for public and private lead service line replacement, utilizing the State Revolving Loan Fund Program and other financial assistance programs for home lead abatement.

Research & Development Recommendations (5)

1. Develop technology to identify buried lead service lines (non-destructive).

2. Advance utility best practices for full (public and private) and partial (public portion only) replacement of lead service lines.

3. Conduct research on the impact of lead in drinking water on human health. This work will assist in identifying an appropriate action level for lead in drinking water.

R & D Recommendations (5)

4. Evaluate the cost effectiveness of point of use (POU) and point of entry (POE) treatment devices for lead removal as an alternative to treatment changes or lead service line replacement to achieve compliance with the Lead and Copper Rule lead action level (currently 15 ppb).

5. Conduct research to determine the best sampling methods to obtain a representative sample of lead in drinking water for purposes of Lead and Copper Rule compliance monitoring.

Approval Process

- The Lead Workgroup met on February 21, 2018 and approved the final version on March 7, 2018 by email
- Recommendations were submitted to US EPA on March 8, 2018, as part of a Federal Consultation Process on the LCR (Peter Goodmann, KDOW)
- The Kentucky Drinking Water Advisory Council approved the recommendations on March 13, 2018.
- A Final Report will be completed in the summer of 2018.

Tom Gabbard

Greg C. Heitzman, PE

Kentucky Lead Workgroup

tom.gabbard@ky.gov

gheitzman@bluewaterky.com

LEAD WORKGROUP

KENTUCKY DRINKING WATER ADVISORY COUNCIL

Message

From: James Taft [jtaft@asdwa.org]
Sent: 2/26/2016 6:45:55 PM
To: Grevatt, Peter [Grevatt.Peter@epa.gov]
Subject: Follow up Items
Attachments: ABC by state memlist.pdf; USA TODAY Qs AND As (2-23-16).docx

Peter, as discussed just now, please find attached our Member List, which shows which state organization each drinking water program resides in. In summary,

- The program resides in mixed health & environment departments in 3 states: SC, CO, and KS.
- The program resides in health departments in 16 states: AR, CT, DE, HI, LA, ME, MN, MS, ME, NY, ND, OR, RI, VA, WV, and WA.
- The program resides in departments of the environment (or natural resources, environmental quality, etc.) in 31 states: AL, AK, AZ, CA, FL, GA, ID, IL, IN, IA, KY, MA, MD, MI, MO, MT, NV, NH, NJ, NM, NC, OH, OK, PA, SD, TN, TX, UT, VT, WI, WY

In addition, please find attached our written responses to the questions posed by USA Today. We also had a verbal interview with them on Tuesday -- which we used to underscore and amplify some of these points.

Jim Taft
Executive Director
Association of State Drinking Water Administrators
1401 Wilson Blvd.
Arlington, VA 22209
Jtaft@asdwa.org
703-812-9507

USA TODAY Qs AND As
February 23, 2016 Draft

"USA TODAY is nearing publication of an article about the approximately 2,000 water systems across the country that have had at least one action level exceedance for lead during the past three years. Most of them, EPA data show, are classified as very small systems. However in total, they serve more than 6 million people, the data show, raising questions about the potential for them being exposed to excessive levels of lead in their water.

We will soon be publishing our analysis. I'm seeking to interview someone early next week (Monday or Tuesday); who from the ASDWA who can help put the federal ALE data into perspective from the point of view of state regulatory agencies? Among the topics I'm seeking to discuss in an interview:"

1. **The reasons water systems tend to have action level exceedances for lead, and why so many with ALEs in the EPA database are small water systems. And whether small systems receive less oversight than large systems.**

   Water systems may have ALE's when two conditions occur: 1) there are water distribution lines – either on publicly owned or privately owned or both – that contain lead and/or lead-containing plumbing fittings/fixtures; and 2) the finished water entering those lines is corrosive and causes leaching of the lead. The chemistry of water in distribution systems is complicated and ensuring that corrosion is controlled is a complicated, ongoing process. As an example, Washington, D.C. triggered exceedances of the Lead & Copper Rule (LCR) in 2003 when adjustments to chemicals added at their treatment facility to better control disinfection by-products inadvertently made the water more corrosive, thus leading to the leaching of lead from portions of the city's water distributions system.

   Over 90% of the 160,000 or so public water systems in the U.S. are small (i.e., serve less than 10,000 people) so it stands to reason, given that inventory, that one would tend to see more small systems than large systems with exceedances. (We would also note that the number of systems with ALEs is a relatively small percentage of the total universe.) Small systems do *not* receive less oversight from states than large systems. In fact, states often spend more time providing technical assistance to and oversight of small systems, due to their particular challenges and need for assistance in maintaining technical, managerial, and financial capacity. Some of these factors may influence the ability of small systems to achieve and maintain optimal corrosion control but each system is different and must be looked at separately.

2. **The reasons some water systems have had multiple ALEs during the past three years and what it means about the safety (from a lead contamination perspective) coming out of taps throughout each of these systems.**

   Broad generalizations, in response to this question, are not possible. One would need to examine each case individually. The question, in each case, would be "what caused the ALEs and what steps were taken to address and correct the problem promptly"? The question of what this means, in terms of safety at the tap, is again, site-specific. Were the

violations in question short duration exceedances slightly over the ALE or were they ongoing exceedances at high levels? These situations would obviously have different implications, in terms of safety at the tap. There are possible small water system implications here as well. Smaller systems take fewer samples; thus, a change in lead concentrations even in one home can have a significant impact on the 90th percentile calculation. In other words, for the smallest systems, only one or two samples above the action level can result in a system being deemed an ALE. In all cases – for both large and small systems – states would work with and oversee their water systems to improve their corrosion control treatment, if appropriate, in order to consistently meet the action level.

Another possible reason for some ALE's is because the LCR requires samples to be collected inside houses and other buildings, and hence allows building residents and homeowners to collect their samples. This is different from how most other drinking water contaminants are sampled. Untrained sample collectors may not always employ proper sample collection techniques, occasionally resulting in unreliable sample results.

3. **The reasons so many schools/day care centers are listed among the ALE systems in the EPA dataset.**

We don't have an explanation for that finding and know of no systemic or inherent reason why schools/day cares would tend to turn up more frequently in the database USA Today examined. Like other small water systems, schools face special challenges with treatment and operation. Also as noted above, small systems are very sensitive to values at one or two sample sites. Historically, school water fountains containing lead were a common problem. Just one high lead content fountain that wasn't previously removed, could trigger an exceedance. Fortunately, these situations are relatively easily resolved (i.e., replacement of the drinking water fountains with lead-free versions).

4. **How the kinds of ALEs regularly occurring across the United States compare with the lead contamination issues in Flint.**

We believe that the situation that occurred in Flint was something of a "perfect storm" – i.e., large community with many lead service lines and a significant change in the quality of the source water. However, the underlying conditions that exist in Flint, with respect to aging infrastructure and with lead service lines exists in many parts of the U.S. (owing to construction and materials practices in the early to mid-20th century). We don't believe the characterization "ALE regularly occurring" is accurate. (Please see EPA's Enforcement and Compliance History Online [ECHO] as well as EPA's yearly reports under its five year strategic plan, and, in particular, Objective 2.1 "Water Safe to Drink.") The vast majority of water systems in the U.S. were in compliance with all health-based standards, including the LCR.

5. **The steps water systems are supposed to take when a single ALE occurs (corrosion control, community education, service line replacement, etc) and whether the required steps are consistently and universally carried out and being enforced. (And when they aren't, why.)**

   The steps mentioned in the question are indeed being carried out and states make every effort to ensure that they're being "universally carried out and enforced." In those exceptional instances when they are not, states, in consultation with their EPA Regional office, implement an Enforcement Response Policy, including an Enforcement Targeting Tool. Please see the above mentioned Enforcement and Compliance History Online for compliance information for both the LCR as well as the other 90+ contaminants regulated by National Primary Drinking Water Regulations.

6. **Whether the sampling regimens (numbers of samples and frequency of samples) required by federal regulations are adequate to assess the public health risks of lead contaminated water to all households served by the system – beyond the few that are tested.**

   Our answer here is a "qualified yes." We believe these protocols and approaches can be protective of public health, but the sample sites need to be properly selected by the water systems and the sampling properly carried out by homeowners. Because finished water leaving a public water system typically has no lead and because the potential for leaching lead is in the distribution system itself, the only foolproof place to sample is at the tap. Relying on homeowners to collect samples from the taps in their homes obviously introduces a potential source of variability (as noted in the response to an earlier question); hence, the need for ongoing outreach and communications to customers.

7. **Why ALEs are not considered to be violations – and what it takes to have a violation for lead.**

   The LCR functions as a "treatment technique rule" rather than as a simple MCL (Maximum Contaminant Level)-type rule; again, because of the unique way in which lead may be enter water distribution systems. The ALE is a trigger to action to reduce lead levels below the ALE by instituting optimal corrosion control. Failure to take appropriate action (which would presumably continue the exceedance of the ALE), constitutes a violation. So, the ALE is not a violation but continued ALEs indicate that violations are probably occurring.

8. **The public perceptions of the sampling and 15 ppb EPA action level as public health safety standards vs. their role as treatment standards.**

   The LCR has been in place since 1991, so public perceptions about the rule, the action level, and the implications of its exceedance is not a new question. The action level is an indicator of the effectiveness of corrosion control. When optimal corrosion control is in place, then less lead should be leaching from plumbing materials and risk to public health is reduced. This is a different regulatory approach than an MCL and understandably makes it more difficult for the public to understand. The rule and its components have obviously received intensive scrutiny, as a result of the Flint crisis. We do support revisions and enhancements of the rule, as discussed below, in accordance with the NDWAC's recommendations; which include approaches such as a household action level -- which makes a more direct link between specific lead levels and public health risk.

9. **Whether the current testing and public notification requirements under federal regulations are adequately protective of public health.**

Please refer to the recommendations of the National Drinking Water Advisory Council (NDWAC) for ways in which testing and public notification requirements can be improved. We also believe that there are a number of steps that we collectively (EPA, states, and water systems) can take to enhance and improve implementation of the LCR, in advance revisions to the rule -- which the NDWAC recommended and EPA is committed to doing.

10. **Whether the way ALEs are calculated (allowing up to 10% of samples to be >15 ppb before an ALE is deemed to have occurred) and the use of 90th Percentile results for reporting has the potential to mislead consumers about the safety and prevalence of lead being found in their water system.**

The rule was designed to be protective and statistically predict that, if corrosion control is maintained as required, water would be safe to drink. By the design of the rule, worst case sites are sampled so that when the action level is met, very few homes should be receiving water in excess of the action level. However, each situation unique. Even if the water systems doing its best on corrosion control (as indicated by the 90th percentile), some locations could be higher. There is no substitute for customers taking an interest and asking for individual home testing. If more than 10 percent of tap water samples exceed the lead action level of 15 parts per billion, then water systems are required to take additional actions including:

- Taking further steps to optimize their corrosion control treatment (for water systems serving 50,000 people that have not fully optimized their corrosion control);
- Educating the public about lead in drinking water and actions consumers can take to reduce their exposure to lead; and
- Replacing the portions of lead service lines (lines that connect distribution mains to customers) under the water system's control.

However, we agree with the NDWAC recommendations that enhancements such as a "household action level", more samples, and more transparency in terms of sharing results with homeowners is needed.

11. **Whether information about lead water tests in water systems' consumer confidence reports provides meaningful information to consumers and whether it has to potential to give a false sense of safety.**

Consumer Confidence Reports simply report on the findings, as referenced in question #10 above. Enhancing the sampling regime and protocol, as referenced above, would be reflected in CCRs. A more important communication tool is the Public Education requirements when the action level is exceeded. This provides information on lead and how to reduce risk to all customers and the general public.

12. **The perspective of ASDWA on whether water containing 15 ppb of lead is <u>safe</u> to drink for a pregnant woman, or an infant fed formula made from tap water, or small children, or other adults? What about 10 ppb? What about 5 ppb?**

    ASDWA (and most states, for that matter) is not in a position to independently evaluate the concentrations of lead, to which the question refers or their protectiveness to vulnerable sub-populations (children and pregnant women). States rely on EPA for the underlying scientific analyses that support drinking water rules, including health effects information. The supporting documentation for the original rule (promulgated in 1991 and revised in 2000 and 2007), addressed protectiveness of the 15 ppb action level as a means to monitor the effectiveness of corrosion control. It is an indirect measure of the health risk and should not be confused with an MCL. We also note that the lead action level and questions about its appropriateness and protectiveness have been conflated, to some extent, with the extremely high levels found in some parts of the Flint distribution system, which were hundreds of times above the action level. We *do* believe that guidance is needed on what lead level poses an acute health risk and should trigger a "do not drink" order from the water system.

13. **The lead contamination risks posed by lead service lines, partial service line replacement – as well as whether water systems have adequately assessed their systems for the presence of lead service lines. In addition, whether water systems have adequately assessed their service line inventories to know whether or not they have lead service lines in order to properly do water sampling at worst-case properties.**

    The NDWAC has recommended (and ASDWA agrees) that partial lead service line replacement is not an effective long term strategy and that our collective focus (federal, state, and local) over the long term, should be on leveraging all tools and resources to *completely* remove lead from distribution systems. The NDWAC recommended actions to get an accurate inventory of lead service lines. Records are often missing, so an accurate inventory in many communities will be difficult. In the initial materials inventory to support sample site selection, systems did their best but more intensive investigations will be needed in many places.

Message

From: Grevatt, Peter [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D3CAA0C39EBE44CB9D3AE44DA7543733-GREVATT, PETER]
Sent: 10/26/2016 12:26:19 PM
To: Alexandra Dapolito Dunn [adunn@ecos.org]
Subject: FINAL LCR White Paper
Attachments: 508_LCR Revisions White Paper_FINAL_10.26.16.pdf

Alex, per my VM yesterday afternoon. The attached white paper will be posted on our website early this afternoon. This will not be public before that time. Please do not share in advance of the release. Please let me know if you want to discuss. Thanks, P.G.

LEAD AND COPPER RULE REVISIONS WHITE PAPER

October 2016

U. S. Environmental Protection Agency

Office of Water

Washington, DC 20460

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I. Executive Summary

Exposure to lead is known to present serious health risks to the brain and nervous system of children. The recent crisis in Flint, Michigan, has brought increased attention to the challenge of lead in drinking water systems across the country. It is important to recognize that major reductions in been achieved in childhood exposure to lead in the United States. Data show that from 1976 – 1980 the median blood lead level of a child (1-5 years old) was 15 micrograms per deciliter. That median level has been reduced dramatically since then, to 1 microgram per deciliter, based on the most recent data. Further, over the last twenty-five years, the percentage of children aged 1–5 years with blood lead levels less than or equal to 5 micrograms per deciliter declined more than ten-fold, and blood lead levels fell dramatically for all racial and ethnic groups. These improvements were made by removing lead from toys and lead solder in cans, taking lead out of gasoline, reducing exposure to lead in paint and dust in homes and during renovations, greatly reducing the allowable content of lead in plumbing materials in homes and other buildings, and further reducing lead in drinking water through the federal Lead and Copper Rule (LCR). Although we have taken significant steps to protect our children from the detrimental effects of lead poisoning, there is more to do.

Lead and copper enter drinking water mainly from corrosion of lead and copper containing plumbing materials. Lead was widely used in plumbing materials until Congress banned its use in 1986, and there are an estimated 6.5 to 10 million homes served by lead service lines (LSLs) in thousands of communities nationwide, in addition to millions of older buildings with lead solder across the U.S. Lead exposure, whether through drinking water, soil, dust or air, can result in serious adverse health effects, particularly for young children. Infants and children exposed to lead may experience delays in physical and mental development and may show deficits in attention span and learning disabilities. In adults, lead exposure can cause kidney problems and high blood pressure. Copper exposure can cause stomach and intestinal distress, liver and kidney damage, and complications of Wilson's disease in genetically predisposed people.

In 1991, EPA promulgated the LCR – a treatment technique regulation under the Safe Drinking Water Act (SDWA) – to protect public health by minimizing lead and copper levels in drinking water, primarily by reducing water corrosivity through corrosion control treatment. This rule applies to 68,000 public water systems nationwide. EPA has continued to work to make the LCR more effective through interim revisions promulgated in 2000 and 2007.

Implementation of the LCR over the past twenty-five years has resulted in major improvements in public health; the number of the nation's large drinking water systems with a 90th percentile sample value exceeding the LCR action level of 15 parts per billion has decreased by over 90 percent since the initial implementation of the LCR. However, the regulation and its implementation are in urgent need of an overhaul. Lead crises in Washington, DC, and in Flint, Michigan, and the subsequent national attention focused on lead in drinking water in other communities, have underscored significant challenges in the implementation of the current rule, including a rule structure that for many systems only compels protective actions after public health threats have been identified. Key challenges include the rule's complexity, the degree of discretion it affords with regard to optimization of corrosion control treatment and compliance sampling practices that in some cases, may not adequately protect from lead exposure, and limited specific focus on key areas of concern such as schools. There is a compelling need to modernize and strengthen implementation of the rule – to strengthen its public health protections and to clarify its implementation requirements to make it more effective and more readily enforceable.

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EPA has conducted extensive engagement with stakeholder groups and the public to inform revisions to the LCR. In December of 2015, EPA received comprehensive recommendations from the National Drinking Water Advisory Council (NDWAC) and other concerned stakeholders on potential steps to strengthen the LCR. EPA is carefully evaluating the recommendations from these groups. In addition, EPA is giving extensive consideration to the national experience in implementing the rule as well as the experience in Flint, MI, as we develop proposed revisions to the rule.

Key Principles for LCR Revisions

EPA's goal for the LCR revisions is to improve public health protection while ensuring effective implementation by the 68,000 drinking water systems that are covered by the rule. This includes strengthening corrosion control treatment in drinking water systems to further reduce exposure to lead and copper and identifying additional actions that will equitably reduce the public's exposure to lead and copper when corrosion control treatment alone is not effective. In developing proposed revisions to the LCR, EPA will be guided by several key principles, including:

- Focus on Minimizing Exposure to Lead in Drinking Water: Improve public health protection by reducing exposure to lead in drinking water to the maximum amount possible through proactive measures to remove sources of lead and educating consumers about the health effects of lead and actions to reduce exposure.
- Clear and Enforceable Requirements: Improve implementation by designing a more prescriptive regulation with fewer discretionary decision points that rely on the judgment of individuals in states and drinking water utilities that may lack expertise in the complexities of corrosion control treatment and distribution system management.
- Transparency: Stronger programs to educate consumers about health risks and actions to reduce exposure to lead in drinking water, better access for consumers to information related to the location of LSLs, and more rapid test results of all tap samples and water quality parameter monitoring.
- Environmental Justice and Children's Health: Because of disparities in the quality of housing, community economic status, and access to medical care, lead in drinking water (and other media) disproportionately affects lower-income people. In addition, lead has disproportionate health effects on infants and children. In revising the LCR, EPA seeks to address environmental justice concerns and to prioritize protection of infants and children who are most vulnerable to the harmful effects of lead exposure.
- Integrating Drinking Water with Cross-Media Lead Reduction Efforts: Leveraging efforts of state and local public health authorities to provide integrated approaches to comprehensively reduce exposure to lead from drinking water, paint, dust, soil and other potential sources of exposure.

EPA is carefully considering NDWAC advice and other stakeholder input and is undertaking key analytical work to develop proposed revisions to the LCR. We are considering an approach that will incorporate both technology- based and health-based elements – to ensure effective reductions of lead in drinking water at the water system level, while at the same time providing consumers with the information, tools and protections needed to address remaining risks. We anticipate that these elements will be supported by clear and robust revised sampling requirements, strengthened reporting, transparency provisions that ensure consumers have rapid access to relevant information and public education materials. Key potential elements under consideration are discussed in Section 3; these elements are highly interdependent, and potential revisions to the rule must be considered in an integrated perspective.

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II. Background

Health Effects of Lead

Over the past decade, epidemiologic studies have consistently demonstrated that there is no safe level of lead. In particular, studies conducted in diverse populations of children consistently demonstrate the harmful effects of lead exposure on cognitive function, as measured by IQ decrements, decreased academic performance and poorer performance on tests of executive function. Lead exposure is also associated with decreased attention, and increased impulsivity and hyperactivity in children. In adults, long-term lead exposure results in increased blood pressure and hypertension. In addition to its effect on blood pressure, lead exposure can also lead to coronary heart disease and death from cardiovascular causes and is associated with cognitive function decrements, symptoms of depression and anxiety, and immune effects in adults.

Health Effects of Copper

Copper has been demonstrated to cause gastrointestinal distress following short term exposure and can cause liver and kidney damage during longer term exposures. Copper exposures are of particular concern for people with Wilson's disease.

Lead in Plumbing Materials

The extent to which leaded materials occur in drinking water distribution systems and plumbing materials in homes and buildings (premise plumbing) varies across the U.S. Much of the variation is due to the quality and age of the housing stock; older homes are more likely to have pipes and plumbing materials containing lead. Where they are present, the most significant source of lead in drinking water are leaded pipes that extend from the water main underneath the street to the residence (lead service lines, or LSLs) however, faucets and fixtures with leaded brass and pipes with lead solder can also contribute to the presence of lead in drinking water. Water chemistry also plays a role in lead levels, because some water sources are more corrosive to leaded plumbing materials if not treated for corrosion control.

In 1986, Congress amended the Safe Drinking Water Act, prohibiting the use of pipes, solder or flux that are not "lead free" in public water systems or plumbing in facilities providing water for human consumption. At the time, "lead free" was defined as solder and flux with no more than 0.2% lead and pipes with no more than 8%. Prior to this, leaded materials were commonly used in plumbing materials and for service lines connecting residences and buildings to water mains. In 1996, Congress further amended SDWA to expand the prohibition to encompass plumbing fittings and fixtures and to prohibit the introduction into commerce of pipes, fitting, and fixtures, solder or flux that is not lead free. The Reduction of Lead in Drinking Water Act of 2011 created exemptions to the prohibitions and revised the maximum allowable lead content from not more than 8% to not more than a weighted average of 0.25% lead on the wetted surface; further reducing the amount of lead in contact with drinking water when that law became effective in January 2014. While these prohibitions have reduced the amount of lead allowed in covered plumbing materials after they went into effect, there are many buildings that still have LSLs and/or plumbing materials made with a higher percentage of lead than currently allowed for new installations or repairs of existing plumbing.

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Summary of the Current Lead and Copper Rule

Under SDWA, EPA establishes national primary drinking water regulations (NPDWRs) which either establish a maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible." The Lead and Copper Rule (LCR) is a treatment technique rule, first promulgated in 1991 and revised in 2000 and 2007, which requires water systems to conduct tap sampling for lead and copper to determine the actions water systems must take to reduce exposure to lead and copper. Recognizing that there is no safe level of lead in drinking water, the LCR set a health-based maximum contaminant level goal of zero. Under the LCR, water systems must work with their customers to collect samples from locations with LSLs and/or leaded plumbing materials. The LCR established action levels of 0.015 mg/L (15 ppb) for lead and 1.3 mg/L (ppm) for copper, based on the 90th percentile sample level.

The action level for copper is set at the health-based maximum contaminant level goal for copper. The action level for lead is based upon EPA's evaluation of available data on corrosion control's ability to reduce lead levels at the tap. Corrosion control treatment (CCT) typically involves the addition of chemicals such as orthophosphate, or chemical adjustment of drinking water pH, to reduce the corrosivity of drinking water and thus the level of leaching of lead and copper from plumbing materials. Whereas an MCL is an enforceable level that drinking water cannot exceed without violation, an action level is a screening tool for determining when certain treatment technique actions are needed. If the lead or copper action level is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the action level), a water system must take certain actions.

The type of action that is triggered depends upon the size of the system and the actions it has taken previously. All water systems serving more than 50,000 people were required to install corrosion control treatment soon after the LCR went into effect. Systems serving less than 50,000 people are not required to install corrosion treatment if the system meets the lead and copper action levels during each of two consecutive six-month monitoring periods. Systems serving less than 50,000 people that exceed the action level and have not yet installed CCT must begin working with their state to monitor water quality parameters and install and maintain CCT. Any system that exceeds the lead action level must conduct public education. Any system with LSLs that exceeds the lead action level after installing CCT must begin LSL replacement (LSLR). Although LSLR programs are conducted by public water systems, in many cases, the portion of the LSL that extends from the water main to the residential property line is owned by the water system, while the portion of the line that extends from the property line to the home is solely owned by the homeowner. Under the current rule, water systems conducting LSLR must offer building owners the opportunity to replace their portion of the line at the time the system is replacing the portion of the service line owned by the system, but the system is not obligated to pay for replacing the portion of the line it does not own.

Key Challenges with the Current Lead and Copper Rule

The LCR is one of the most complicated drinking water regulations for states and drinking water utilities to implement due to the need to control corrosivity of treated drinking water as it travels through often antiquated distribution and plumbing systems on the way to the consumer's tap. The LCR is the only NPDWR that requires sampling in homes, often by the consumers themselves. The rule includes complex sampling and treatment technique requirements intended to protect against exposure to lead and copper in drinking water. States and public water systems must have expertise and resources to identify the sampling locations and to collect and analyze samples correctly. Even greater expertise is needed for

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systems and states to identify on a system-specific basis the optimal CCT and water quality parameter monitoring to assure effective operation. The current structure of the rule compels additional protective actions on the part of a water system only after a potential problem has been identified, which may create a disincentive for utilities to identify potential problems with lead and copper in the drinking water system. It is also worth noting that road construction activities or maintenance of gas or buried power lines can cause disturbance of LSLs, in some cases introducing high levels of lead into drinking water through the release of lead particulates into the drinking water distribution system.

When corrosion control alone is not sufficient, LSLR, public education, and further actions on the part of consumers to reduce their exposure to lead are necessary. Consumers' ability to understand and afford these actions can pose challenges. In most communities, LSLs are partially owned by the utility and partially owned by the homeowner; the cost of full LSLRs has been estimated to be $2,500-$5,500 per line, but some industry estimates for an average replacement are as high as $8,700 per line.

Summary of National Drinking Water Advisory Council Recommendations

The National Drinking Water Advisory Council (NDWAC) is a Federal Advisory Committee that supports EPA in performing its duties and responsibilities related to the national drinking water program. The council was created through a provision in the SDWA of 1974. The NDWAC LCR Working Group was formed to provide advice to EPA in considering potential revisions to the LCR. In December 2015, the NDWAC provided specific recommendations to the Administrator for LCR revisions including:

- Require proactive LSLR programs, which set replacement goals, effectively engage customers in implementing those goals, and provide improved access to information about LSLs, in place of current requirements in which LSLs must be replaced only after a lead action level exceedance (ALE);
- Establish more robust public education requirements for lead and LSLs, by updating the Consumer Confidence Report (CCR), adding targeted outreach to consumers with LSLs and other vulnerable populations (pregnant women and families with infants and young children), and increasing the information available to the public;
- Strengthen CCT, retaining the current rule requirements to re-assess CCT if changes to source water or treatment are planned, adding a requirement to review updates to EPA guidance to determine if new scientific information warrants changes;
- Modify monitoring requirements to provide for consumer requested tap samples for lead and to utilize results of tap samples for lead to inform consumer action to reduce the risks in their homes, to inform the appropriate public health agency when results are above a designated household action level, and to assess the effectiveness of CCT and/or other reasons for elevated lead results;
- Tailor water quality parameters (WQPs) to the specific CCT plan for each system, and increase the frequency of WQP monitoring for process control;
- Establish a health-based, household action level that triggers a report to the consumer and to the applicable health agency for follow up;
- Separate the requirements for copper from those for lead and focus new requirements where water is corrosive to copper; and
- Establish appropriate compliance and enforcement mechanisms.

Summary of Other Stakeholder Input

EPA has also received recommendations for revisions to the LCR from other stakeholders including a NDWAC Working Group member who dissented on a number of the NDWAC recommendations, the

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Flint Water Interagency Coordinating Committee, and local citizens impacted by the experience in Flint. These recommendations emphasize the importance of enforceable goals for LSLR, recognize the significant lead exposure risks that can accompany partial service line replacements (PLSLRs) and provide clearer and more prescriptive requirements for sampling and corrosion control protocols that reduce the opportunities for systems to generate biased sampling results or improperly implement corrosion control procedures. EPA has received input from other stakeholders similarly concerned with eliminating PLSLRs and strengthening the sampling and corrosion control provisions of the LCR. In addition, the Board of the American Water Works Association (AWWA), which represents drinking water utilities, voted unanimously in March of 2016 to support the NDWAC recommendations, including those that would ultimately lead to complete replacement of LSLs.

III. Key Issues and Potential Elements under Consideration

EPA expects that proposed revisions to the LCR will include both technology-driven and health-based elements that focus on proactive, preventative actions to avoid high lead levels and health risks. In addition, we expect to propose robust and ongoing communication and information sharing with consumers that will foster actions by consumers to reduce risks. The potential elements under consideration are interconnected components that together will address the challenges with the current rule and improve public health protection in the revised rule.

In developing revisions to the LCR, EPA must adhere to the SDWA's statutory requirements and achieve the greatest public health protection feasible. The SDWA requires that any treatment technique rule must prevent known or anticipated adverse effects on the health of persons to the extent feasible and revisions to any NPDWR must maintain or strengthen public health protection. In addition, EPA must prepare a Health Risk Reduction Cost Analysis to evaluate if the benefits justify the costs of the rule. EPA is committed to using the best available science. As knowledge about lead contamination in drinking water evolves, we will continue to engage with stakeholders and consider their viewpoints and relevant science in developing revisions to the LCR.

Lead Service Line Replacement

As noted above, LSLs, which connect a residence or building to the water main, can be a significant source of lead in drinking water. The total number of LSLs currently in use in the US is unknown; estimates range from 6.5 million to greater than 10 million homes that have service lines that are at least partially made of lead. The current LCR requires LSLR only after a lead ALE, and allows partial LSLR when an owner of a home or building is unable or unwilling to pay for replacement of the portion of the service line not owned by the water system.

In 2010, EPA asked its Science Advisory Board to evaluate the data regarding the effectiveness of the partial LSLR, in comparison to full line replacement. The EPA Science Advisory Board concluded in its 2011 report to EPA that:

> PLSLRs have not been shown to reliably reduce drinking water lead levels in the short term, ranging from days to months, and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. Available data suggest that the elevated tap water lead levels

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tend to then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR.[1]

Much of the discussion regarding potential LCR revisions has focused on mandatory, proactive LSLR, as a potential opportunity to eliminate one of the primary sources of lead in drinking water, thus reducing reliance on corrosion control to reduce lead in drinking water at the tap.

The NDWAC has recommended that the Agency require proactive full LSLR programs with the following elements:

- Requiring all PWSs to establish a LSLR program that effectively informs and engages customers to encourage them to share appropriately in fully removing LSLs, unless the system can demonstrate that LSLs are not present in their system;
- Targeted outreach to customers with LSLs, with information about the risks of lead exposure, an offer to test a tap sample, and information about and encouragement to participate in the LSLR program;
- Dates by which systems should have met interim goals and completed replacement of all LSLs and partial LSLs, without penalty to the water system for those homeowners who refuse to participate in the replacement program as long as the water system has made a meaningful effort to work with such a homeowner;
- Creating incentives for understanding where LSLs and PLSLs exist, while making action on full replacement, rather than on investigation of the location of LSLs and PLSLs the priority;
- Maintaining ongoing-outreach to homeowners where LSLs or PLSLs still exist;
- Implementation of standard operating procedures (SOPs), either from EPA guidance or tailored to the system, that helps define operations that disturb LSLs and practices to minimize disturbance and consumer exposure to lead; and
- Stronger programs to educate consumers, and to provide test results of tap samples at the request of consumers.

It is important to recognize that LSLR presents substantial economic, legal, technical and environmental justice challenges. First, it is costly. Estimated costs for LSLRs range from $2500 to more than $8000 per line, suggesting an estimated cost of eliminating all 6.5 to 10 million LSLs nationwide ranging from 16 to 80 billion dollars. Potential costs may be disproportionately borne by specific low-income localities, such as Detroit, which has an estimated 100,000 LSLs and where 40 percent of the population is below the poverty line. Second, LSLs are often partially or totally owned by private homeowners. Under the current LCR, public water systems are responsible for replacement of LSL or the portion of the LSL it owns. This is typically the portion of the line from the water main to the property line. There are important legal questions about EPA's authority to mandate replacement of privately owned portions of lines and about water systems' authority under state or local law to require and/or pay for such replacement. To the extent water systems rely on homeowners to pay for replacement of privately owned portions of lines, there are concerns about consumer's ability to pay and the possibility that lower-income homeowners will be unable to replace lines, resulting in disparate levels of protection. However, a number of cities and towns across the nation have successfully implemented full LSLR and have developed innovative approaches to addressing these challenges, including Lansing, Michigan; Madison, Wisconsin; and more recently Boston, Massachusetts – and EPA is looking at this experience in the context of developing proposed revisions to the LCR.

[1] Science Advisory Board, U.S. Environmental Protection Agency, "Evaluation of the Effectiveness of Partial Lead Service Line Replacements," transmitted to Lisa Jackson, EPA Administrator, September 28, 2011.

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EPA is considering proposing full LSLR programs. In assessing options for an LCR revision proposal, EPA is evaluating a number of important issues, including:

- The appropriate pace of LSLR and the mechanism for implementing and enforcing any LSLR program requirements. Consideration of number of LSLs that can feasibility be replaced on an annual basis will need to be considered as well as water system size.
- Costs and benefits of LSLR for reducing lead exposures. National costs could range from 16 to 80 billion dollars. Benefits will be estimated based upon avoided effects of lead exposure such as IQ loss in developing children. EPA will evaluate how much additional lead exposure reduction can be achieved in removing LSLs from water systems with optimized corrosion control. EPA will also evaluate other measures that can reduce lead exposure to assure that resources are focused on reducing the most significant sources of lead.
- How to provide for full LSLR where the utility does not own the full line, including an evaluation of whether a potential change to the definition of "control" under the SDWA would facilitate full LSLR.[2]
- Requiring drinking water utilities to update their distribution system materials inventory to identify the number and location of LSLs in their system.
- How to address potential equity concerns with LSLR requirements and consumers ability to pay for replacement of their portion of the LSL. Identifying and evaluating incentive and creative funding mechanisms are critical as is encouraging use of Drinking Water State Revolving Fund to the extent possible.
- How to address LSLR in rental properties, particularly where low income residents do not control the property or have the ability to contribute to the cost of LSLR.
- Whether to prohibit or otherwise limit partial LSLR, and how to address concerns related to potential disturbance of LSLs during emergency repairs to water mains that are connected to LSLs.
- How to address the short term increases in lead levels that can follow LSLRs (i.e., requiring water systems to provide filters when lines, or enhanced household flushing recommendations).

Improved Optimal Corrosion Control Treatment Requirements

Optimal Corrosion Control Treatment (OCCT) is the primary treatment technique on which the LCR focuses, and as noted above, it has been successful on a national basis in reducing lead and copper levels at the tap. Even if the revised LCR includes requirements for full LSLR, full replacement of LSLs would likely take decades to complete, and LSLR will not address potential risks from lead and copper materials present in premise plumbing in tens of millions of homes across the U.S. As a result, CCT requirements will continue to be a key element of a revised LCR.

Since the initial implementation of the LCR, systems have faced ongoing challenges of continuing to maintain optimal corrosion control while making necessary adjustments to treatment processes or system operations unrelated to corrosion control to comply with other NPDWRs. Determining whether treatment is optimized can be challenging for individual systems, given the wide variability in

[2] The Safe Drinking Water Act defines the term public water system as "...a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least fifteen service connections or regularly serves at least twenty-five individuals. Such term includes (i) any collection, treatment, storage, and distribution facilities ***under the control of*** the operator of such system and used primarily in connection with such system, and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system."

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distribution system composition, source water characteristics and approaches to complying with other NPDWRs, such as the surface water treatment rules. While the impact of changes in some water quality parameters on lead and copper levels are well understood, such as fluctuations in pH or alkalinity, others are more complex, such as the quantity and type of disinfectant used or the chemical composition of the protective scales within the LSLs. Small and medium systems (those serving <50,000 persons) are not required to commence development of a CCT plan under the existing LCR unless they have a lead ALE.

The NDWAC recommends that:

- EPA release a revised CCT guidance manual as soon as possible and update this manual every six years, so that PWSs and primacy agencies can take advantage of improvements in the science;
- EPA provide increased expert assistance on CCT to PWSs and primacy agencies;
- The LCR continue to require re-evaluation of CCT when a PWS makes a change in treatment or source water;
- The LCR continue to require water quality parameter monitoring to ensure that the OCCT is achieving the treatment objectives and that EPA consider requiring such monitoring on a more frequent basis with additional guidance on process control methods; and
- Large systems review their existing CCT plan in light of current science in a newly revised guidance manual with their primacy agency to determine whether the WQPs reflect the best available current science.

Recognizing the continuing central importance of CCT in reducing lead exposures, EPA is considering a range of options for strengthening CCT requirements in the proposed rule that could help to provide clearer requirements, reduce uncertainty, and ensure broader and more consistent proactive application of CCT to avoid high lead levels. Options under consideration include:

- Requiring large water systems (serving > 50,000 persons) to evaluate and re-optimize CCT when EPA publishes updated CCT guidance. This option would provide a mechanism to ensure water systems are considering the best available science to inform treatment decisions.
- Given that CCT is also effective at reducing lead leaching in premise plumbing (not just LSLs), requiring all systems in the U.S. to implement CCT, regardless of system size, tap sampling results, or the presence of LSLs; or alternatively, broadening the categories of systems for which CCT is required; requiring all systems to assume that their distribution system includes the presence of LSLs unless or until they provide the primacy agency with a robust distribution system materials evaluation that demonstrates that this is not the case.
- Requiring water systems that are already applying CCT that exceed the lead action level to evaluate and re-optimize CCT.

Incorporating a Health-Based Benchmark to Strengthen Protection

Although the current LCR is focused on protecting public health by reducing lead and copper exposures, it does so through "technology-based" requirements. The 1991 LCR established an action level for lead of 15 ppb (for the 90th percentile sample) based on an assessment that it was generally representative of effective CCT. Although public discussion often mistakes the action level as having significance in terms of health impacts, EPA has consistently emphasized that the health-based maximum contaminant level goal (MCLG) for lead in the current LCR is zero and that there is no safe level of lead exposure. While the future LCR will maintain treatment technique requirements (e.g., CCT, public education and LSLR) to reduce lead exposures, a health-based benchmark for lead in drinking water could help to guide appropriate actions to communicate and mitigate risk, particularly at the household level.

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As part of its 2015 recommendations, the NDWAC suggested that EPA establish a "household action level" based on the amount of lead in drinking water that would raise an average, healthy infant's blood lead level to greater than five micrograms per deciliter based on consumption of infant formula made with water. According to the NDWAC recommendations, water systems would be required to notify the consumer and the local public health agency if this level were exceeded – with the expectation that individuals and local officials will use this information to take prompt actions at the household level to mitigate lead risks.

While EPA has not yet determined the specific role of a health based benchmark for lead in drinking water in the new rule, the Agency sees value in providing states, drinking water systems and the public with a greater understanding of the potential health implications for vulnerable populations of specific levels of lead in drinking water. EPA is currently developing up-to-date scientific modeling of the relationship between lead levels in drinking water and blood lead levels – particularly for sensitive lifestages such as formula-fed infants and children under age 6. EPA expects to conduct an expert peer review panel to identify approaches to derive a health based value for lead in drinking water. Following this public peer review process, EPA expects to evaluate and determine what specific role or roles a health-based value may play in the revised LCR. EPA anticipates that the proposal will consider the "household action level" approach recommended by the NDWAC, but a health-based value could also help to inform other potential elements of a revised LCR – including public education requirements, prioritization of households for LSLR or other risk mitigation actions at the household level, and potential requirements related to schools or other priority locations.

Considering the Potential Role of Point of Use Filters

One of the insights that has emerged from work in response to the crisis in Flint, Michigan, is the efficacy of point-of-use household filters in reducing lead levels at the tap. There are a broad array of point-of-use filters that are certified by independent third party labs for lead reduction. Recently, EPA collected samples from these filters installed on taps in Flint, Michigan, and verified that these filters are effective in reducing lead levels. Filters require periodic replacement of cartridges to remain effective. The SDWA requires point of use devices specified as a feasible technology to achieve compliance with an MCL or treatment technique requirements to be owned, controlled, and maintained by the water utility. While filters are not an appropriate substitute for CCT, LSLR, or other actions to properly manage and reduce lead levels at the system level, EPA is considering role for filters in addressing risks from lead and copper at the household level. Potential roles include requiring point of use filters where there has been a disturbance of a LSL or where tap sampling indicates an exceedance of a health-based benchmark or action level.

Clarify and Strengthen Sampling Requirements

The goal of the LCR sampling requirements – including site selection criteria and tap sampling procedures — is to cost effectively assess the effectiveness of a water system's CCT and to trigger additional actions to reduce exposure when necessary. The target locations in the LCR are focused on the homes that are likely to have the highest risk for lead exposure. The lead sampling protocol requires a one liter first draw sample collected after water has remained stagnant for at least 6 hours. Implementation of the sample site selection criteria and the sampling protocol are challenging and provide opportunity for error, particularly given that samples are collected by the residents themselves. In addition, numerous stakeholders have criticized the current rule as providing too much discretion in sampling approaches and providing opportunities for systems to implement their sampling procedures

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to avoid exceeding the action level, even in circumstances where corrosion control has not been optimized.

On February 29, 2016, EPA issued a memorandum encouraging states and drinking water utilities to implement protective LCR sampling procedures, based on lessons learned in Flint, Michigan, and other communities. These sampling procedures include eliminating the practice of flushing the tap prior to the mandatory 6-8 hour stagnation period (pre-stagnation flushing), ensuring that faucet aerators are not removed prior to conducting tap sampling under the LCR, and encouraging the use of wide mouth bottles for collection of tap samples to avoid the loss of any of the first draw sample. EPA expects to incorporate each of these recommended sampling procedures as proposed requirements in the proposal for the revised LCR.

In addition, EPA has increased oversight of state programs to ensure effective implementation of the LCR. As part of these efforts, EPA sent letters on February 29, 2016, to state commissioners to ensure consistency with EPA regulations and guidance. The letter requested that primacy agencies work collaboratively with EPA to ensure national consistency and improve transparency and public information regarding the implementation of the rule.

The majority of the states confirmed that they have been consistent with EPA guidance and the LCR. Some primacy agencies specifically stated in their response that they would be undertaking steps to ensure that their protocols and procedures follow the LCR and applicable guidance. Regarding the use of EPA guidance on LCR sampling protocols and optimization corrosion control procedures, the majority of the primacy agencies confirmed that they use relevant guidance and protocols for sampling and corrosion control. Some primacy agencies had previously encouraged pre-flushing but stated they would update their protocols to ensure consistency with the recently published EPA sampling memo.

The NDWAC recommends that a voluntary customer-initiated sampling program based on a more robust and targeted public education be substituted for the current LCR tap sampling requirements.
The results of the voluntary tap sampling program would be used for three separate purposes:

- Informing and empowering individual households to take action to reduce risk;
- Reporting to health officials when monitoring results exceed a “household action level”; and
- Providing an ongoing source of information to the utility to assess effectiveness of CCT.

In the proposed LCR revisions, EPA intends to propose clear and robust sampling requirements to serve the goals of: (1) providing appropriately robust information on how the overall system is performing in reducing lead levels; and (2) providing information on household levels that can be compared to health-based levels, to help guide mitigation actions at individual homes.

EPA is continuing to evaluate specific procedures for tap sampling, including:

- The continued use of “first draw” tap samples, sequential sampling to characterize lead levels in drinking water that has been in contact with premise plumbing and the LSL, random daytime samples, whether the rule should include a variety of tap sampling protocols to meet different needs for customers and the system, and whether the rule should provide for systems to sample customer’s taps on request.
- Mandatory sampling for schools that are not public water systems in the revised LCR, given the presence of vulnerable populations in the school environment and the ongoing challenges that schools continue to encounter with elevated lead levels in drinking water.

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- ORD partnering with technology developers in industry and academia to identify available technologies that can be used to support real-time monitoring of water quality parameters for measuring the effectiveness of corrosion control in the distribution system.

Increased Transparency and Information Sharing

Transparency and public sharing of data and information is a cornerstone of EPA's efforts to strengthen the effectiveness of its rules. The drinking water crisis in Flint, Michigan, and subsequent focus on lead issues in other communities has underscored the need for transparency with the public in implementing actions to reduce lead in drinking water. EPA took important steps to advance these efforts on February 29, 2016, when the Agency sent letters to every governor and drinking water primacy agency responsible for implementing the LCR, urging a series of actions to address risks from lead in drinking water. The Agency called on primacy agencies to work with public water systems to increase transparency in implementation of the LCR by posting on their public websites:

- the materials inventory that systems were required to complete under the LCR, including the locations of LSLs, together with any more updated inventory or map of LSLs and lead plumbing in the system; and
- LCR compliance sampling results collected by the system, as well as justifications for invalidation of LCR samples.

The Agency also asked that states enhance efforts to ensure that residents promptly receive lead sampling results from their homes, together with clear information on lead risks and how to abate them, and that the general public receives prompt information on high lead levels in drinking water systems.

Many of the responses from state commissioners identified practices and policies that enhance the implementation of the LCR and increase public transparency. States identified opportunities to promote transparency at the state level by posting individual lead compliance samples, and not just the 90th percentile values on their public websites utilizing the Drinking Water Watch or similar tools. To complement this effort, some public water systems are providing online searchable databases that provide information on known locations of LSLs, or providing videos that show homeowners how to determine whether their home is served by a LSL.

To shorten reporting and notice timeframes, some states have adopted more stringent timelines for water systems to provide consumer notices to all who receive water from sites that were sampled and resulted in a lead ALE. While the LCR allows up to 30 days, some states are requiring notice to consumers as quickly as 48 hours after sampling. In addition, some states require laboratories that analyze lead compliance samples to contact the state within 24 hours of confirming that a sample analysis has exceeded the 15 parts per billion action level for lead. Consistent with the EPA's 2013 E-Reporting Policy[3] the agency intends to use, to the maximum extent practicable, common agency tools, information systems, and data sets for E-Reporting for the revised LCR. E-Reporting can facilitate faster access to data and other information critical to consumers to understand lead and copper levels in their drinking water and within the water system and to make informed decisions regarding actions they may take to reduce exposure from lead in drinking water.

The NDWAC recommends that EPA strengthen requirements for public access to information about LSLs, tap monitoring results and other relevant information. Enhanced requirements for sharing compliance

[3] https://www.epa.gov/compliance/policy-statement-e-reporting-epa-regulations

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data and other information with the public can play a critical role in strengthening the protections provided by the LCR. By providing individuals and communities with prompt and accurate information, the LCR can help to leverage broader public involvement and engagement in ensuring accountability, consistency in meeting regulatory requirements, and prompt action to mitigate high lead levels or other risks, both at the system and household level.

Accordingly, the agency expects to propose stronger public transparency elements for the revised LCR. Measures under consideration include:

- Requiring drinking water utilities to post all LCR sampling results and sample invalidation justifications on their publicly accessible website in a form that protects the privacy of customers;
- Mandating shorter time frames for providing lead sampling results to consumers;
- Mandating shorter time frames for providing the public with public health education when high lead levels are detected in their drinking water system;
- Enhanced requirements for sharing the results of the materials evaluation conducted by drinking water system, including publicly identifying the location of LSLs within the community in a way that protects privacy of homeowners;
- Enhanced requirements for states to publicly identify each system within their state that is currently or has recently experienced an ALE, along with the specific steps the system is required to fulfill and their progress in implementing these requirements
- Requiring systems to provide information on the number of lead tap samples collected, number of samples that exceed the lead action level, information about voluntary sample results and any recent changes to CCT or water quality parameters that might affect lead levels in their water; and
- Requiring more timely electronic reporting of sampling results to primacy agencies and EPA.

Public Education Requirements

A critical element of the LCR is public health education to ensure that the public has easy access to clear information on lead and copper risks in drinking water and how to mitigate them. The current LCR requires public health education in response to a lead ALEs. One concern with this approach is that systems can have up to 10 percent of homes with highly elevated levels of lead in drinking water without causing an ALE and triggering the public health education requirements of the rule.

The NDWAC recommends that:

- EPA establish an easily accessible, national clearinghouse of information about lead in drinking water to serve the needs of the public and of public water systems;
- Require information be sent to all new customers on the potential risks of lead in drinking water;
- Revise the current CCR language to address LSLs and update the health statements;
- Add requirements for targeted outreach to customers with LSLs; and
- Expand the current requirements for outreach to caregivers/health care providers of vulnerable populations.

EPA is considering modifications to the rule to strengthen the public education requirements by requiring ongoing, proactive and targeted public education to effectively communicate drinking water lead risks, promote tap sampling, and provide actions consumers can take to reduce lead exposures regardless of ALEs by the system.

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The Agency is also considering requiring water utilities to provide information on lead risks to all new customers at the time of service connection, expanding the current LCR requirements for public outreach to caregivers and healthcare providers for vulnerable populations, and revising the current requirement for CCRs so that these reports address the status of LSLs in each city.

Customers with LSLs are at heightened risk for lead exposures in drinking water. EPA is considering a number of potential public education requirements in the proposed LCR revisions to help mitigate these risks, including:

- Requiring water systems to provide targeted outreach to customers with LSLs and to provide these customers with invitations to have their water tested and to participate in a LSLR program, regardless of ALEs in the system;
- Requiring water system to provide public access for LSL inventories, which would include the locations of those service lines;
- Requiring that customers be notified of emergency or planned maintenance that may disrupt LSLs, therefore increasing lead levels, and be provided with information on actions that can be used to mitigate exposure; and
- Requiring a standard operating procedure be prepared and provided to other utilities who may disturb LSLs for maintenance or capital improvements.

Potential Revised Copper Requirements

Published corrosion literature since 1991 on copper has shown that copper and lead leaching patterns differ. The current LCR sample site selection criteria targets highest-risk lead sites, and tap samples for both lead and copper are collected at these locations. Some stakeholders have expressed concerns that elevated levels of copper may be missed using this approach.

The NDWAC Recommends:

- Instead of basing action on the results of routine, in-home copper sampling, actions should be based on the aggressiveness of the water to copper. Systems can determine if their water is aggressive to copper by doing WQP monitoring in the distribution system. All PWSs should be assumed to have water that is aggressive to copper unless they demonstrate that it is not.
- EPA should develop criteria to define water that is not aggressive to copper for the purpose of establishing whether a system falls into that category (or "bin") for the purposes of the LCR. EPA should consider the accuracy and potential variability of pH and alkalinity monitoring as well as corrosivity to copper in establishing pH and alkalinity ranges. The criteria also should include consideration of passivation time.
- PWSs can choose one of several approaches to demonstrate that their water is not aggressive to copper.
- PWSs with water classified as non-aggressive to copper must continue to demonstrate that the water is non-aggressive. PWS's can choose to:
    - Maintain those WQPs that demonstrate it maintains non-aggressive water, or
    - Conduct copper sampling at vulnerable homes (houses < 2 years old with new copper plumbing) to demonstrate that water chemistry is non-aggressive cooper levels fall under the AL/MCL).

EPA is considering modifications to the LCR requirements to provide greater attention to the potential risks associated with elevated levels of copper in drinking water. Options that are being considered include modifications to the sample site selection criteria to include sites that are at greatest risk of producing elevated levels of copper, and developing water quality parameters designed to identify

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systems that have water aggressive to copper. Systems with aggressive water could be required to install CCT and/or conduct public education for copper, while systems with nonaggressive water could be required to periodically demonstrate that leaching of copper is not a concern for the water system.

Relationship with Broader Lead Issues

While the LCR revisions are focused on lead in drinking water, EPA recognizes that the ultimate goal is comprehensive reduction in exposures to lead from all contaminated media, some of which may present greater risks than drinking water in individual communities or homes.

Lead can be ingested from various sources, including lead paint and house dust contaminated by lead paint, as well as soil, drinking water, and food. The effects of lead exposure are generally measured by blood lead levels. As a result of the multitude of possible exposure pathways, the contribution from specific pathways (e.g., consumer products, diet, soil, ambient air) to blood lead concentrations can vary widely for each individual.

Young children, infants, and fetuses are particularly vulnerable to lead because their behavior patterns typically lead to higher exposures, they absorb a greater proportion of the lead they ingest than adults, physical and behavioral effects of lead occur at lower exposure levels in children than in adults, and the central nervous system of children undergoes rapid development and impacts during this period can have lifelong effects.

EPA estimates that drinking water can make up 20 percent or more of a total exposure to lead. In some circumstances, infants who consume mostly mixed formula can receive 40 percent to 60 percent of their exposure to lead from drinking water. Current water sampling protocols were designed to assess the adequacy of CCT, not the level of human exposure to lead. Important fluctuations in water lead levels can be missed because of limitations inherent in sampling protocols that EPA uses, making it difficult to assess household exposure through drinking water.[4]

Pathways of exposure to lead related to ambient air include both inhalation of lead and ingestion of lead in dust or soil that originated in the ambient air. For example, dietary lead exposure may be air-related if ambient air lead deposits on plant materials or in water that becomes available for human consumption. (They may also be water-related if cooking is undertaken in tap water with high lead levels.)

Dust and soil particles containing lead are typically in the size range that is ingested rather than inhaled. However, soil can act as a reservoir for deposited lead emissions, and exposure to soil contaminated with deposited lead can occur through re-suspended particulate matter as well as hand-to-mouth contact, which is the main pathway of childhood exposure to lead.

To address these concerns, EPA is committed to continuing to work with federal, state and local partners to reduce lead risks in all contaminated media.

[4] Brown, Mary Jean and Margolis, Stephen, Division of Emergency and Environmental Health Services, National Center for Environmental Health, Centers for Disease Control, "Lead in Drinking Water and Human Blood Lead Levels in the United States," *Morbidity and Mortality Weekly Report*, August 10, 2012.

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IV. Conclusion

It is critical that EPA thoughtfully revise the LCR to strengthen the rule to reduce exposure to lead in drinking water, especially for infants and children and communities bearing a disproportionate risk. It is also important that LCR revisions improve implementation and enforceability of the rule requirements. This paper provides examples of regulatory provisions EPA is considering and evaluating in order to improve public health protection. While EPA has received extensive recommendations from NDWAC and other stakeholders, the Agency is committed to continue to engage with stakeholders and consider all viewpoints in revising the LCR. EPA is committed to using the best available science and to conducting robust analyses of regulatory options that have been informed by stakeholder input. The Agency welcomes input and feedback on the ideas presented in this paper to support development of a Notice of Proposed Rulemaking of LCR Revisions for publication in the Federal Register and public review and comment in 2017.

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Message

From: Grevatt, Peter [Grevatt.Peter@epa.gov]
Sent: 5/22/2016 8:54:02 PM
To: tmehan@awwa.org
CC: Greene, Ashley [Greene.Ashley@epa.gov]
Subject: ACE Q&A

Tracy, here are some additional questions that could work for ACE, depending on the interest of the audience. I realized over the weekend that I was in error when I sent you my schedule for breakfast this week. Wednesday is the only day that works for me and I think that was out for you. I'll be tied up all day on Thursday and I have a very long travel day tomorrow with a round-trip to Denver. I might be able to do something in the afternoon on Tuesday. Please feel free to work with Paula to see whether there is a time we can work out. Thanks, P.G.

Lead and Copper

- What do you view as the most important lessons from Flint for the water sector?
- How do you see that the experience in Flint has impacted the public confidence in the safety of drinking water? How do you believe we should address those issues?
- Has Flint changed the regulatory outlook for EPA on lead or other issues?
- What are your thoughts on the effectiveness of the LCR? How can it be improved?

Health advisories

- When does EPA choose to issue a health advisory versus and MCL/G? Is one more protective than the other?

Technology and Innovation

- What do you believe are some of the advances in technology that will improve the water sector? Challenges?

Looking Forward

- What do you believe the water sector can do to increase transparency and public awareness?

Closing

- What should every citizens know about their drinking water?

From: Tracy Mehan [mailto:tmehan@awwa.org]
Sent: Thursday, May 19, 2016 4:45 PM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Cc: Patricia Chism <pchism@awwa.org>
Subject: RE: ACE Q&A

Peter,

You can also just send me a few questions you would like me to ask.

That said, I could do breakfast either Tuesday or Thursday next week.

Thanks.

Tracy

From: Grevatt, Peter [mailto:Grevatt.Peter@epa.gov]
Sent: Thursday, May 19, 2016 4:33 PM
To: Tracy Mehan <tmehan@awwa.org>
Subject: RE: ACE Q&A

Sounds good Tracy. I'm now doing a day trip to Denver on Monday (!) so I can be back for a meeting I need to attend here in DC on Tuesday. We have the first of our 3 stakeholder forum meetings on Thursday. Wednesday might be ideal for coffee or possibly breakfast. Please let me know what works best for you. Thanks, P.G.

From: Tracy Mehan [mailto:tmehan@awwa.org]
Sent: Thursday, May 19, 2016 4:24 PM
To: Grevatt, Peter <Grevatt.Peter@epa.gov>
Subject: ACE Q&A

Peter,

I am starting to compile a list of questions for our session at ACE. I will be happy to share them with you when I have worked them over a bit. If you have any you want to add, I could compile them into one document to discuss with you. Maybe something next week? Thanks.

Tracy

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Message

From: Helm, Erik [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=8C6770EF5BB04224A198D70B5988B765-EHELM]
Sent: 2/20/2014 8:59:31 PM
To: dosterhoudt@asdwa.org
Subject: Presentation Preparation for the NDWAC LCR Working Group Meeting (March 25-26)
Attachments: ndwac white paper dec11-12-2013.pdf; NDWAC Presentation 508 Template.pptx; NDWAC LCR meeting one draft agenda (2-12-14).docx

Dear Darrell,
Thank you, for agreeing to make a presentation on Lead and Copper Rule implementation to the National Drinking Water Advisory Council (NDWAC) Lead and Copper Working Group. The Working Group will be providing advice to the NDWAC as it develops recommendations for the EPA on targeted issues related to long-term revisions to the Lead and Copper Rule (LCR).

EPA's goal for the long term revisions to the LCR is to improve the effectiveness of corrosion control treatment in reducing exposure to lead and copper and to trigger additional actions that equitably reduce the public's exposure to lead and copper when corrosion control treatment alone is not effective. In making improvements to the LCR, EPA also seeks to advance the goal of environmental justice, which is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income.

In particular, EPA is seeking recommendations from the NDWAC upon the following targeted issues:

- Implementing requirements to ensure that corrosion control treatment is optimized to most effectively reduce lead and copper levels at consumers' taps.
- Updating the sample site selection criteria and sampling procedures for lead tap monitoring.
- Revising the lead service line replacement (LSLR) requirements.
- Requiring copper consumer education.

The meeting at which Optimal Corrosion Control Technology information will be presented to and discussed by the NDWAC Working Group is scheduled for March 25-26, 2014. Your presentation will be on March 25. In order to help you prepare for this meeting and your presentation, I have attached to this email a white paper (you have seen this before), which describes the issues and questions for which EPA is seeking stakeholder input in achieving the goals of the rule revisions. This document is meant to lay the initial foundation for NDWAC discussions of the issues listed above. Additional detailed technical information is to be provided by the presenters at the NDWAC Working Group meeting, additional detailed topic papers provided by EPA, and through additional Working Group questions and requests for information. As a presenter, this document can help you understand the larger context of the NDWAC discussion and where your presentation fits. It is our job as an outside expert presenter to help in the development and presentation of the materials the NDWAC Working Group needs to inform their recommendations on the questions listed in the white paper.

There are some additional logistical issues discussed below.

The presentation should be about 20 to 30 minutes long. There will be an equal amount of time for questions after each presentation. Your presentation will follow Eric Brunson's. He will give a SDWA and Lead and Copper Rule overview of requirements (the presentation will be very similar to the one he gave at the December NDWAC meeting0. A draft agenda for this first NDWAC Working Group meeting is attached.

Because this is a public process and these presentations will be made available to the public, EPA is required by Section 508 of the Rehabilitation Act (29 U.S.C. § 794d) make sure that these materials are accessible to people with

disabilities. In this case, your presentation will have to be converted into a Section 508 compliant format for the visually impaired. To make this easier I have attached a template presentation and ask that you use this template and, unless necessary, refrain from using too many pictures and graphics in your presentations.

Although your presentation is currently planned to take place in person at the first scheduled meeting of the NDWAC Working Group, your presentations will also be webcast for other NDWAC member who wish to attend remotely. Because of the Section 508 requirements and the technical complications of the webinar, EPA requests that you provide a draft of your presentation a week and a half in advance of the Working Group meeting in late March.

The final draft of your presentation will be due the week before the NDWAC Working Group meeting.

If you have any questions about this process, what is required, or ideas to improve materials being presented, please do not hesitate to contact me at 202-566-1049 or helm.erik@epa.gov.

Thank you again for your invaluable assistance with this NDWAC Working Group process and the Lead and Copper Rule revisions.

Erik Helm

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LCR Long-term Revisions White Paper

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Background for the Current Lead and Copper Rule Revisions Process

Under the Safe Drinking Water Act (SDWA) EPA sets public health goals and enforceable standards for drinking water quality.[1] The Lead and Copper Rule (LCR) is a treatment technique rule. Instead of setting a maximum contaminant level (MCL) for lead or copper, the rule requires public water systems (PWSs) to take certain actions to minimize lead and copper in drinking water, to reduce water corrosivity and prevent the leaching of these metals from the premise plumbing and drinking water distribution system components and when that isn't enough, to remove lead service lines.

The current rule sets an action level, or concentration, of 0.015 mg/L for lead and 1.3 mg/L for copper. An action level is not the same as an MCL. An MCL is based on health effects; whereas an action level is a screening tool for determining when certain treatment technique actions are needed. Because the LCR is a treatment technique rule, the LCR action level is based on the practical feasibility of reducing lead through controlling corrosion. In the LCR, if the action level is exceeded in more than ten percent of tap water samples collected during any monitoring period (i.e., if the 90th percentile level is greater than the action level), it is not a violation, but triggers other requirements that include water quality parameter monitoring, corrosion control treatment (CCT), source water monitoring/treatment, public education, and lead service line replacement (LSLR). The rule also requires States to report the 90th percentile for lead concentrations to EPA's Safe Drinking Water Information System (SDWIS) database for all water systems serving more than 3,300 persons, and for those systems serving fewer than 3,300 persons only when the lead action level is exceeded. States only report the 90th percentile for copper concentrations in SDWIS when the copper action level is exceeded in water systems regardless of the size of the service population. Public education requirements ensure that drinking water consumers receive meaningful, timely, and useful information that is needed to help them limit their exposure to lead in drinking water.

In early 2004, EPA began a wide-ranging review of the implementation of the LCR to determine if there was a national problem related to elevated levels of lead in drinking water. As part of its national review, EPA collected and analyzed lead concentration data and other information, carried out a review of implementation in States, held four expert workshops to discuss elements of the regulations, and worked to understand local and State efforts to monitor for lead in school drinking water, including a national meeting to discuss challenges and needs. EPA released a Drinking Water Lead Reduction Plan (DWLRP) in March 2005. This plan outlined short-term and long-term goals for improving implementation of the LCR. The plan can be found at the following web address:
http://water.epa.gov/lawsregs/rulesregs/sdwa/lcr/lead_review.cfm

In 2007, EPA promulgated regulations, which addressed the short-term revisions to the LCR that were identified in the 2005 DWLRP. These requirements enhanced the implementation of the LCR in the areas of monitoring, treatment, LSLR, public education, and customer awareness. These revisions better ensured drinking water consumers receive meaningful, timely, and useful information needed to help them limit their exposure to lead in drinking water.

EPA has continued to work on the long-term issues that required additional data collection, research, analysis, and full stakeholder involvement, which were identified in the 2005 DWLRP and the 2007 rule revisions. This new action is referred to as the LCR Long-term Revisions (LTR) The LCR LTR would apply to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs). EPA's primary goal for the LCR-LTR is improve the effectiveness of the corrosion control treatment in reducing exposure to lead and copper and to trigger additional actions that equitably reduce

[1] EPA establishes national primary drinking water regulations (NPDWRs) under SDWA. NPDWRs either establish a feasible maximum contaminant level (MCL) or a treatment technique "to prevent known or anticipated adverse effects on the health of persons to the extent feasible."

the public's exposure to lead and copper when corrosion control treatment alone is not effective. While not inclusive of all potential revisions to the LCR, key categories where revisions are being considered are:

- Sample site selection criteria for lead and copper
- Lead sampling protocols
- Public education for copper
- Measures to ensure optimal corrosion control treatment
- Lead service line replacement

Previous Federal Advisory Committee Involvement

EPA has sought input from Federal Advisory Committees on two previous occasions. The Science Advisory Board (SAB) provides comments to EPA on the quality and relevance of scientific and technical information supporting EPA's national drinking water standards. The Office of Ground Water and Drinking Water (OGWDW) formally requested SAB evaluation of current scientific data to determine whether partial lead service line replacements are effective in reducing lead drinking water levels. The SAB issued their report on September 28, 2011. (See http://yosemite.epa.gov/sab/sabproduct.nsf/0/964CCDB94F4E6216852579190072606F/$File/EPA-SAB-11-015-unsigned.pdf)

EPA also previously consulted with the National Drinking Water Advisory Council (NDWAC) in meetings on July 21-22, and November 18, 2011(see http://water.epa.gov/drink/ndwac/meetingsummaries/index.cfm) and wrote a letter to EPA on December 23, 2011 (see http://water.epa.gov/drink/ndwac/upload/ndwaclettertoepadec2011.pdf).

EPA continues to require input on the feasibility, and cost effectiveness of potential revisions to the Lead and Copper Rule. Therefore, EPA is convening a NDWAC working group to consider several key questions for the LCR LTR, taking into consideration previous input.

Key Issues for Consideration

EPA's goal for the LCR-LTR is to improve the effectiveness of corrosion control treatment in reducing exposure to lead and copper and to trigger additional actions that equitably reduce the public's exposure to lead and copper when corrosion control treatment alone is not effective. Lead and copper are present in plumbing materials and water distribution system components throughout the United States. Therefore, treating the water to make it less likely to corrode lead and copper from these materials remains the most cost effective way to reduce exposure to these metals. However, because corrosion control is not always effective, the LCR must compel additional actions in those systems that cannot sufficiently reduce lead and copper levels. Those actions should provide equitable protection to all of the consumers. In making these improvements, EPA seeks to advance the goal of environmental justice, which is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. The following is a description of key issues and questions for which EPA seeks stakeholder input in achieving these goals. This document is meant to lay the initial foundation for the stakeholder process, with more detailed technical information and questions likely to be raised during future working group meetings.

A. Sample Site Selection Criteria

Goals/objectives of rule change: In the preamble to the LCR in 1991, EPA wrote that it believes, "…that the requirement to collect samples from locations that are most likely to have high concentrations of lead and copper in drinking water is reasonable and necessary given the nature of the problem of corrosion…" Thus, the goal of the LCR sample site selection criteria is to target locations with high-risk lead and copper in drinking water systems in a cost-effective manner. Selection and use of the highest risk sites is important, because the number of samples collected is relatively small and contaminant levels can vary between systems and sites based on water quality, and distribution system and usage characteristics. Targeting these locations helps ensure that appropriate action is taken if a lead or copper problem is identified in the system.

Background Information

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. The figure below outlines the current rule requirements.

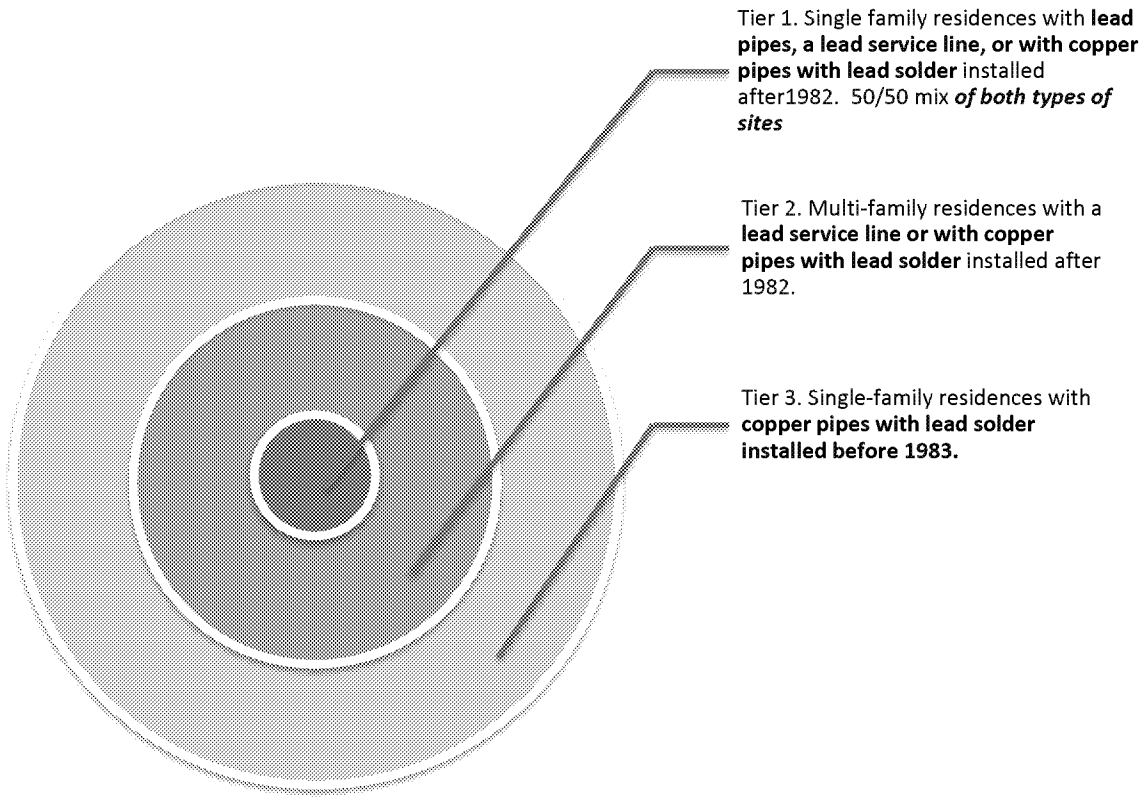

Figure 1: Current Site Selection (tiering) Structure

Although EPA made short-term revisions to the LCR in order to address some implementation issues in January 2000 (65 CFR 1950) and October 2007 (72 CFR 57781), the Agency has not revised the tiering criteria since the rule was promulgated in 1991. New information exists regarding lead and copper release

patterns, which raises 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. PLSLRs 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. The current criteria do not solely prioritize sampling from LSLs (full or partial).
- Over twenty years have passed since lead solder was banned in all jurisdictions. Because lead release from solder decreases with time, these sites now are likely to be releasing levels of lead comparable to contributions by brass plumbing components and interior pipe corrosion byproduct scales.
- Studies have shown that much higher lead levels are frequently found in water in contact with lead service lines.
- 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.

Copper

Since 1991, a large body of published corrosion literature on copper has shown that copper and lead release patterns differ. The original LCR sample site selection criteria for copper no longer targets highest-risk copper, since these sites have now aged. 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. 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.

Lead and Copper

- Differences exist between lead and copper release patterns in water systems.
- Water chemistry variations within the water distribution system vary temporally and spatially. This phenomenon affects the site selection for lead, as well as copper. In order to capture high-risk sites, it is important that sampling reflect 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 and copper in drinking water than originally believed, especially in newer homes.

EPA is evaluating whether the sampling sites as outlined in 1991 are still the appropriate sites to monitor to assess the effectiveness of corrosion control treatment for both lead and copper. EPA is revisiting these criteria to examine whether they target the sites most likely to leach elevated levels of lead and copper

and, thus, serve as good indicators of whether corrosion control treatment is needed or has been optimized. Selection and use of the highest risk sites is important, since the number of samples collected is relatively small, contaminant levels can vary between systems and sites (water quality, plumbing configuration(s), and usage patterns contribute to variations in lead and copper levels). Public health protection is the main goal of the LCR, but because the LCR is a treatment technique rule, sites are selected to assess performance of systems' corrosion control treatment not to assess exposures.

- In order to better target each contaminant, EPA is considering revising the site selection criteria to create two separate tiering structures, one for systems with LSLs and another for systems without LSLs.
- EPA also is evaluating whether to monitor at separate sites for copper. EPA is considering requiring PWSs to conduct copper monitoring at separate sampling sites with new copper piping, which are likely to have elevated copper levels.
- EPA also is considering allowing a copper monitoring waiver which would allow systems with water qualities not considered aggressive to copper to eliminate copper monitoring. This copper waiver could reduce costs for systems that can demonstrate water qualities which are unlikely to leach copper (e.g. a system that provides no disinfection or oxidation treatment, and meets a specific pH criterion; or a system with disinfection and/or oxidation treatments that has water quality parameters within the specified pH and alkalinity ranges).

Discussion questions:

- How should sample site selection criteria be developed to capture the highest risk sites for both lead and copper in a simple, health protective, and cost effective way? Is the knowledge base on both lead and copper sufficient to confidently respond to the question?
- At what sites should lead and/or copper samples be taken to be representative of the greatest release for each contaminant?
- Should sampling for lead and copper occur at separate sites? If so, what could the potential sampling scheme look like?
- What are the cost implications of developing separate sampling sites
- 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?
- How many samples for each contaminant would be needed to be statistically significant?
- What age copper piping should be sampled in order to capture the greatest likelihood of copper release?
- In what ways could evaluating water quality parameters from all systems be used to help identify systems with zones of water quality aggressive to copper? For lead?
- 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?
- What might copper waiver conditions look like, including water quality and non-water quality based conditions?
- How many systems can consistently meet water quality parameters, showing that water is not aggressive to copper, to obtain a copper waiver?

- 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

B. Lead Sampling Protocol

Goals/objectives of rule change: Establish procedures that will result in a PWS having a set of samples that will assess the corrosivity of the water being provided and/or to indicate if the corrosion control is effective in reducing lead and/or copper corrosion from LSLs and plumbing materials.

Background

The current LCR contains a single sampling procedure for both sites with lead service lines and sites with lead-soldered copper pipes. A one-liter first draw sample (no water wasted prior to drawing the sample) is taken after a minimum six-hour stagnation time. The current sampling protocol allows residents to collect the first-draw samples.

Lead Service Line Sampling

EPA analyzed data from a number of studies where sequential samples were taken at the same site to generate a profile (i.e. several consecutive liters of water were taken and analyzed until water that had been in contact with the LSL was reached) and found that the first draw sample may underestimate the amount of lead that can be in samples in contact with the LSL. Where they are present, LSLs (full or partial) are the greatest source of lead in the distribution system. EPA is considering different sampling procedure options for sites with a partial or fully intact LSL to better assess the amount of lead contributed by lead service lines and, thus, whether further action is needed to reduce the corrosivity of the water.

One service line sampling approach is to collect and discard a specific number of liters prior to taking (using a fresh bottle) a one-liter sample representative of the service line. The sampling instructions would be the same for all sites in the sampling pool. A challenge to this approach is determining the specific number of liters to collect and waste to get a representative sample, since plumbing configurations and service line lengths will vary across sites.

Another service line sampling approach is to collect a series of sequential samples at each site in the sampling pool to identify the liter containing the highest lead at the site (an initial profile), and use that site-specific identified liter for subsequent monitoring and compliance purposes. In subsequent monitoring periods, the number of liters to get to that sample would be wasted before the one-liter service line sample for that site would be collected in a new sample bottle. The volume of water being wasted prior to sample collection will vary among sites under this approach. This approach seeks to balance obtaining site-specific samples while reducing analytical costs since sequential sampling to identify the liter containing the highest lead would be conducted one time at each location and when new sampling sites were added to the pool. An important consideration with this approach would be whether the added complexity could be appropriately managed by the public and drinking water utilities to ensure reproducible results.

The logistics of sampling present other challenges, e.g. in working with homeowners to collect service line samples.

Aerators

Another sampling instruction issue is the inclusion of recommendations to remove the aerator and clean it before the start of the stagnation period. EPA issued guidance on October 20, 2006 indicating that PWSs should not recommend that customers remove or clean aerators before or during the collection of tap samples for lead. While removal and cleaning of the aerator is advisable on a regular basis, if customers are only encouraged to remove and clean aerators prior to drawing a sample for lead, the system could fail to identify the typically available contribution of lead from that tap and thus fail to take additional actions needed to reduce exposure to lead in drinking water.

Pre-stagnation Flushing

A third sampling instruction issue for service line samples is pre-stagnation flushing and what that means with respect to whether the sample was in contact with the faucet and interior plumbing or with the lead service line. Some systems' sampling instructions recommend flushing the tap for an extended period of time (5 minutes or longer) prior to the start of the minimum six-hour stagnation time. Concerns about this practice include whether it leads to biasing the sample downward (e.g. by flushing particulates). One approach would be to prohibit recommendations on pre-stagnation flushing in the sampling instructions. EPA is looking for input on other alternatives that best represent the water in the service line.

Number of Required Sample Sites

The number of sample sites in the current LCR varies by the size of the system and monitoring frequency. The number of sites range from 5 to 100 under standard monitoring and from 5 to 50 under reduced monitoring. Each sample is analyzed for both lead and copper. The distribution of sample sites is not addressed in the current LCR. A sampling protocol that better represents the contribution of the service line to lead levels in the water may allow a reduction in the number of sites that need to be monitored to assess the effectiveness of corrosion control in lead service line systems.

The number of sample sites needed to target high-risk sites (and to assess corrosion control for those systems using CCT) should be considered for systems with and without LSLs. Sampling sites that better represent the contribution of copper may necessitate separate sampling sites, and perhaps a different number of samples, for lead and copper, rather than a single sample being analyzed for both contaminants. LSL samples may not adequately reflect copper levels because of limited contact with copper; however, it may be possible to assess the effectiveness of corrosion control solely by the lead levels from the service line samples.

Another issue is that a water system may have a variety of water sources within its system, and the sampling sites as they are currently configured may not be able to capture all the water quality variability (which affects lead and copper corrosion) within the distribution system. Thus, it may requiremore specific targeting of sampling sites to assess over all corrosion control effectiveness given this variability.

While there are a variety of factors that can influence the number of sampling sites necessary to assess the effectiveness of corrosion control in an individual system, the LCR does need to have baseline monitoring for all classes of systems for effective rule implementation.

Discussion questions:

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- For locations with LSLs, what does a cost-effective lead sampling procedure look like that captures lead where concentrations are likely highest?
  - Who should collect samples? The PWS? The homeowner/resident? If the latter, how can the procedure be reliably executed? How can instructions to homeowners/residents be as clear and easy to follow as possible?
  - Should aerator removal be addressed? If so, how?
  - What are the pros and cons of addressing pre-stagnation flushing of pipes? How should this issue be addressed, if at all? What is the best way to represent the water in the service line?
  - What are the advantages/disadvantages of a single prescriptive liter versus a site-specific sequential sampling approach?
  - Under what conditions could OCCT be based on the lead results from the lead service line samples?
- What is an appropriate number of samples to be collected by a water system to capture the highest risk lead and copper sites in the distribution system and, where CCT is in place that will indicate if the corrosion control is effective in reducing lead? In reducing copper?
  - How important is the size of the PWS population in determining this number?
  - How much does geographic distribution of samples matter, particularly with respect to non-homogenous water quality and non-homogeneous construction distribution?

C. Public Education for Copper

Goals/objectives of rule change: To improve the health of consumers by motivating consumers to take actions in reducing exposure to copper in drinking water in systems with elevated copper levels.

Background

While corrosion can occur to copper plumbing of any age, in 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. Corrosion of new copper pipes is not a problem for many water systems. It is limited to water systems that have water quality that is aggressive to copper. The health effects of copper are nausea and vomiting (short-term), and there may be liver damage and possible nervous system effects in sensitive subpopulations (e.g. individuals with Wilson's disease). Both the maximum contaminant level goal (MCLG) and action level for copper (1.3 mg/L) were established based on the prevention of acute nausea as a result of elevated copper levels in drinking water. EPA recommends that individuals with Wilson's disease should consult their personal physician if the levels of copper in their water exceed the action level. Infants fed formula prepared with copper-tainted tap water consume a higher amount of tap water on a per body weight basis than adults, which may increase their risk for an adverse response.

Currently, there are no public education materials[2] or informational statements[3] provided on the health risks of copper exposure, or steps consumers can take to reduce their risk of exposure. EPA is evaluating whether materials should be provided to consumers to address potential exposures to copper in premise

[2] These "public education materials" may be delivered to all consumers in the distribution system when the public water system has exceeded the copper action level. The mechanism of delivery could be similar to the way consumers are educated about lead after a lead action level exceedance.

[3] The term "informational statements" describes educational materials that would be delivered to consumers in the distribution system when systems have water quality that is aggressive to copper but delivery would not be based on exceeding the copper action level

plumbing. EPA is also evaluating the target audience for any materials that might be developed. The Agency is considering requiring copper public education materials for systems exceeding the copper action level and/or a brief informational statement to consumers served by systems which have water quality aggressive to copper.

Outreach materials[4] could explain the potential health effects of elevated copper, the likelihood of copper levels being higher at newly built homes and buildings where water quality is aggressive to copper, and actions that the consumer can take to reduce their exposure to copper.

The following are key elements that EPA is considering for a public education requirement for copper in the event of a copper action level exceedance:

(1) Explanation of what copper is, the possible sources of copper in drinking water and how copper enters drinking water;
(2) Explanation of copper health effects;
(3) Steps the consumer can take to reduce their exposure to copper in drinking water;
(4) Explanation of why there are elevated levels of copper in the system's drinking water (if known) and what the water system is doing to reduce the copper levels in homes/buildings in the area; and
(5) Explanation of the likelihood of concern related to copper leaching from copper pipes in homes/buildings in the area.
(6) Explanation of what other plumbing materials are available for use in water qualities aggressive to copper, that a builder or consumer might choose to reduce their exposure to undesirable levels of copper in the water.

Discussion questions:

- Are there aesthetic warning signals of copper corrosion in drinking water and, if so, what are they and what recommendations should be given to consumers to help them avoid the health effects of copper through consumption of drinking water?
- Should copper public education materials be included in the LCR using the same basic structure as the public education materials for a lead action level exceedance?
- Should different types of outreach materials to consumers with different content be required depending on whether or not the copper action level is exceeded? If so, what information should be included (e.g., public education for an action level exceedance, informational statement about copper if an action level is not exceeded)?
- If copper public education materials or informational statements are required, what should the delivery frequency be?
- If public education is not required for copper action level exceedances, should EPA require systems to deliver outreach materials/informational statement to consumers who visit or live in a newly/recently built or renovated building/dwelling with new copper piping?
  - Should systems be required to identify newly/recently built or renovated building/dwelling with new copper piping?
  - Should systems be required to work with local inspection services to incorporate the outreach materials or informational statement into building/dwelling occupancy permits?
  - How much and what kind of direction should be provided by EPA with respect to public education materials or informational statements?

[4] The term "outreach materials" is a general term used to describe any materials that are distributed to the public.

- If a water system demonstrates water quality aggressive to copper, should those consumers receive informational statements about copper? If so, what information should be included?

D. Measures to Ensure Optimal Corrosion Control Treatment

Goals/objectives of rule change: Enhance the process for systems to improve the effectiveness of their corrosion control treatment; ensure adequate incentives for optimization and provide greater clarity about treatment optimization.

Background information

The Lead and Copper Rule requires systems to install optimized corrosion control treatment (OCCT) while insuring that the treatment does not cause the water system to violate any NPDWRs. Since the promulgation of the LCR and the initial optimization of corrosion control, systems have faced the ongoing challenge of continuing to maintain optimal corrosion control while making necessary adjustments to treatment processes or system operations unrelated to corrosion control to comply with other NPDWRs. The current optimization process includes requirements for systems to:

- Conduct monitoring
- Conduct a CCT study (if required by the State)
- Obtain State designated OCCT
- Adjust existing CCT
- Conduct follow-up monitoring
- Obtain State review of installation of CCT and designation of optimal water quality parameters (OWQPs)
- Operate the treatment in compliance with OWQPs

Research has shown that there are many factors that can affect lead and copper levels. Maintaining OCCT can be challenging; therefore EPA is evaluating a number of revisions to the corrosion control requirements that make targeted improvements to the current process:

- Expand scope of study for systems with LSLs to include a system-wide assessment of factors that may limit the effectiveness of the CCT or the ability of the system to optimize their treatment. Allow the State and/or EPA to tailor study requirements for systems without LSLs. LSLs contribute about 50-70% of the total mass of lead at consumer's taps. To a lesser extent, premise plumbing contributes about 20-35% of total lead mass measured at the tap and meters contribute less than that.
- Consistent with international experience, require systems using orthophosphate to evaluate higher doses and those systems not using orthophosphate to study its use for their system.
- Revise steps and deadlines for corrosion control treatment.
- Allow Non Transient Non Community Water Systems (NTNCWSs) serving fewer than 10,000 people the option of installing Point of Use (POU) treatment units in lieu of having to install CCT as a potentially more effective mechanism to reduce lead exposures in these systems.

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Determining whether treatment is optimized can be challenging, given the variety among systems in their distribution system composition, water qualities and other circumstances. One idea under consideration is the addition of a system-wide assessment as part of the mandatory CCT study requirements for systems with LSLs. This is intended to ensure the studies are comprehensive and that the proposed treatment addresses any existing or anticipated water quality, treatment or operational issues that may interfere with or limit the effectiveness of the corrosion control optimization or re-optimization.

While some changes are well understood for their potential to adversely affect lead and copper levels, such as fluctuations or changes in pH or alkalinity, others are more complex and involve factors like the quantity and type of disinfectant used or the chemical composition of the protective scales within the lead service lines. In a system-wide assessment, a water system will evaluate the variability of water quality throughout the distribution system due to differences in source water quality within distinct hydraulic boundaries, different or variable residence times and multiple types of distribution system materials. Revisions to the study elements would also target key parameters that are known to affect or limit the effectiveness of CCT generally, such as the variability of pH and alkalinity, as well as more system-specific water quality or process control parameters. Since the promulgation of the original LCR, research has confirmed the most effective treatments for optimization of corrosion control are pH/alkalinity adjustment, and the use of orthophosphate. Consequently, EPA is considering removal of the requirement for systems to study calcium hardness adjustment as a potential option for optimizing corrosion control, along with the associated mandatory monitoring for calcium, conductivity and water temperature. EPA is also considering more specific requirements for systems that are currently not using orthophosphate to study the use of orthophosphate and for systems using orthophosphate to study the use of higher dosages of orthophosphate. EPA will consider alternatives to orthophosphate where appropriate and effective to reduce the waste water discharge burden of phosphorous in those areas sensitive to phosphorous release.

A key provision of the LCR requires water systems to sample for State approved OWQPs. OWQPs are measurable indicators that help systems determine if they are maintaining optimal CCT. Corrosion control treatment techniques are means specified in the rule, such as pH/alkalinity adjustment and the addition of corrosion inhibitors (e.g., orthophosphate) that promote the formation of insoluble scales that prevent lead from leaching from pipes into the drinking water. Having proper OWQPs is the method by which EPA, States, and water systems know whether water characteristics are in the ideal range (determined through CCT optimization studies) for their corrosion control methods.

After water systems recommend OWQPs, it is up to the States to approve them. Currently, OWQP ranges may not be set as tightly as needed to effectively control lead corrosion for those systems that continue to exceed the lead action level. EPA is evaluating whether to require systems exceeding the lead action level to re-optimize CCT, before being triggered into LSLR, and if that re-optimization process should be well-defined.

Under the current LCR, a system that exceeds an action level is required to install CCT, but may cease conducting lead and copper tap and WQP monitoring while it is evaluating and installing CCT. Regular monitoring during this timeframe may provide additional information to the systems and States to ensure the proper treatment is installed and fully optimized.

EPA is considering designating lead service line systems that have optimized or re-optimized corrosion control for lead to also be deemed to have optimized corrosion control for copper.

Discussion questions:

- How can LCR requirements be structured to encourage optimal corrosion control treatment and retain enforceability?

- How can existing OWQP monitoring requirements be strengthened while retaining implementability? What is the most effective way for reducing lead exposure?
- What are the challenges to optimizing corrosion control treatment?
- What are some of the lessons learned from implementing corrosion control treatment?

E. Lead Service Line Replacement

Goals/objectives of rule change: Remove sources of lead in the distribution system; encourage optimization of CCT to prevent lead leaching; address environmental justice concerns associated with LSLR; and maintain and enhance enforceability of the LCR.

Background

Under the current LCR, water systems that exceed the lead action level after the installation of CCT and/or source water treatment must annually replace at least seven percent of the initial number of LSLs in their distribution system. To meet the seven percent annual LSLR requirement, systems can do full or partial LSLRs or "test out" a LSL if all samples from it are at or below the lead action level (*i.e.*, a "tested-out" line is not physically replaced, but is still counted as such for the seven percent LSLR requirement). A concern with "test outs" is they may not reliably reflect the lead levels in the water because they only represent a single snap shot in time. Under the current LCR, systems must replace the portion of the LSL they own/control. Where a system does not own/control the entire LSL, it must offer to replace the owner's portion at his or her expense. If the owner elects not to have his or her portion replaced, then the system is not required to replace the privately-owned portion. This results in a PLSLR.

One of the challenges of full LSLR versus PLSLR is environmental and public health equity among customers of different economic means and home ownership status.

For the LCR, EPA's current interpretation of the term "control" is limited to what a water system owns. But in the original 1991 LCR EPA established a broad definition of control as it applies to LSLs in the distribution system that included: (1) authority to set standards for construction, repair or maintenance of the line; (2) authority to replace, repair or maintain the service line; or (3) ownership of the line. American Water Works Association challenged EPA's original definition of control. The court remanded the matter because EPA failed to provide adequate notice and comment on the control definition. In 1996, EPA proposed a revised definition of control. EPA solicited comments regarding the degree to which systems may have the authority to replace the privately-owned portions of LSLs. EPA also solicited comments regarding the option of only requiring replacement of the portion of the LSL owned by the system. In the final rule in 2000, EPA elected to define control as ownership to eliminate confusion and avoid rule implementation delays. Thus, under the current LCR a water system is not required to pay the cost of replacing the portion of the LSL that it does not own.

EPA asked the Science Advisory Board (SAB) to evaluate the current scientific data regarding the effectiveness of PLSLR and the review centered around five issues: (1) associations between PLSLR and blood lead levels in children; (2) lead tap water sampling data before and after PLSLR; (3) comparisons between partial and full LSLR; (4) PLSLR techniques; and (5) the impact of galvanic corrosion.

The SAB found that the quantity and quality of the available data are inadequate to fully determine the effectiveness of PLSLR in reducing drinking water lead concentrations. The small number of studies available had major limitations (small number of samples, limited follow-up sampling, lack of information about the sampling data, limited comparability between studies, etc.) for fully evaluating

PLSLR efficacy. Nevertheless, despite these limitations, the SAB concluded that PLSLRs have not been shown to reliably reduce drinking water lead levels in the short-term, ranging from days to months, and potentially even longer. Additionally, PLSLR is frequently associated with short-term elevated drinking water lead levels for some period of time after replacement, suggesting the potential for harm, rather than benefit during that time period. The available data suggest that the elevated tap water lead levels tend to increase then gradually stabilize over time following PLSLR, sometimes at levels below and sometimes at levels similar to those observed prior to PLSLR.

The SAB also concluded that in studies comparing full LSLR versus PLSLR, the evaluation periods were too short to fully assess differential reductions in drinking water lead levels. However, the SAB explained that full LSLR appears generally effective in reliable achieving long-term reductions in drinking water lead levels, unlike PLSLR. Both full LSLR and PLSLR generally result in elevated lead levels for a variable period of time after replacement. The limited evidence available suggests that the duration and magnitude of the elevations may be greater with PLSLR than full LSLR.

EPA is contemplating several revisions to mandatory LSLR requirements. Options that would be helpful to evaluate include:

- Delaying mandatory LSLR requirement until after CCT re-optimization.
- Considering an expanded definition of control similar to what was included in the 1991 LCR to facilitate full LSLRs.
- Eliminating the requirement to do a PLSLR when the property owner does not agree to pay for the replacement of the portion of the LSL on private property after the action level has been exceeded. Full LSLR would be required by the LCR if the water system owns the entire LSL, or the property owner agrees to pay for the replacement on the private side or if the water system voluntarily pays the entire cost after the action level has been exceeded.
- Eliminating the "test-out" provision.
- Requiring water systems to provide impacted owners and residents with a NSF/ANSI 53 certified pitcher-filter or other treatment unit that removes lead before the system begins any LSLRs.

Discussion Questions:

- Has the seven percent annual LSLR requirement been an effective part of the LCR and, if so, what has been achieved? How does it impact compliance tracking and enforcement? If PLSLR requirements were to be eliminated, what other options could accomplish similar results?
- Should EPA consider another percentage requirement for LSLRs instead of 7%? If so, what. What would the impact be on incentives for treatment optimization?
- If PLSLRs and "test outs" are no longer allowed, then how might a water system obtain a sufficient number of agreements from owners and residents to achieve full LSLRs at an annual rate of at least seven percent?
- When optimization does not bring lead levels under the action level how should systems reduce exposure from LSLs in a way that protects public health, is feasible and assures equitable protection among the system's users?
- If EPA requires the public and privately-owned portions of the LSLs to be removed, how would systems go about educating owners and residents about the importance of LSLR once triggered into the mandatory replacement program?

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- Would water systems be more likely to achieve greater LSLRs with an expanded definition of control? What would result if EPA does not change the definition of control?
- What are the environmental justice concerns associated with LSLRs? How can an even distribution of benefits be achieved, to avoid either disproportionate health or economic impacts?
- If the definition of control is expanded beyond ownership and the water system is required to replace the entire LSL, including any portion on private property, how can costs be allocated equitably?
- What measures might a PWS and/or its customers employ to address temporarily elevated lead levels during the times of exposure when LSRL and/or reoptimization is occurring?

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Message

From: Steve Via [SVia@awwa.org]
Sent: 8/7/2019 3:56:55 PM
To: Helm, Erik [Helm.Erik@epa.gov]
Subject: RE: Article you mentioned in the OMB meeting yesterday
Attachments: 2019 04 Cotruvo Lead Reduction National Success Story.pdf

Joe Cotruvo. Copy attached. Please note that the only aspect of this opinion article that I referenced was the reduction of observed lead body burden.

Thanks,
Steve

Steve Via
Director Federal Relations, AWWA | 202.326.6130

From: Helm, Erik <Helm.Erik@epa.gov>
Sent: Wednesday, August 7, 2019 11:52 AM
To: Steve Via <SVia@awwa.org>
Subject: Article you mentioned in the OMB meeting yesterday

Steve,

You mentioned an resent AWWA article that characterized PWS lead concentrations and BLLs over time in the call yesterday with OMB. I missed the author's name. Could you give me the reference?

Thanks Erik

Erik C. Helm, Ph.D.
Senior Economist
U.S. Environmental Protection Agency
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Targeting and Analysis Branch
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OPINION

JOSEPH A. COTRUVO

Cotruvo

Lead Reduction Is a National Success Story

David Cornwell's October 2018 *Journal AWWA* article "How Have We Done in Reducing Lead in Water Since the LCR?" and earlier writings demonstrate that, when enforced, the Lead and Copper Rule (LCR) has been effective in improving corrosion control, reducing the number of lead service lines, and contributing to further reductions of child blood lead levels (BLLs). The October 2018 special issue of *Journal AWWA*, which was focused on distribution systems and corrosion control, provided a body of information describing how water professionals are addressing lead and corrosion issues.

LEAD REDUCTION EFFORTS

The spike in lead levels in Flint, Mich., circa 2014 and the issues that plagued the city afterward wouldn't have occurred if standard treatment practices had been applied and the state effectively enforced existing regulations. Although lead in water will remain a concern as long as lead-containing pipes and fittings and galvanized pipes are still in service, the average and peak BLLs in US children have drastically declined in the past 40 years, primarily as a result of eliminating lead in automobile gasoline, paint, food-can and water pipe solders, and millions of service lines, as well as reducing lead in brass water fixtures.

Between 1976 and 1980, average BLLs in US children aged six months to five years were about 16 µg/dL (µg per 100 cc of blood), according to the National Health and Nutrition Examination Survey (NHANES II). Further, the survey noted that 63.3% of BLLs were in the 10–19 µg/dL range, and 0.1% were in the 50–59 µg/dL range. The national mean values were down to 2.7 µg/dL by 1991 and to 1.9 µg/dL by 2002. The mean in 2014 was 0.84 µg/dL, according to a study by Hernán Gómez and colleagues that appeared in the June 2018 issue of *Pediatrics*. Given this trend, it's probably even lower today.

As of 2012, the Centers for Disease Control and Prevention (CDC) "reference" level for BLLs is 5 µg/dL, reduced from the prior 10 µg/dL "concern" level. The reference level is based on the 97.5th percentile of national BLLs in children being less than 5 µg/dL, at which point follow-up action is recommended to determine and eliminate the cause of any exceedance. Subtle, but potentially reversible, IQ losses are suspected to potentially occur at levels about 5–10 µg/dL or perhaps lower, as discussed in a Mar. 22, 2016, PBS.org article by Ellen Ruppel Shell (https://to.pbs.org/2R946o8). CDC recommends that chelation therapy for lead poisoning be considered if BLLs exceed 45 µg/dL. Mental developmental deficits can occur at considerably lower concentrations.

Although high lead concentrations were measured in Flint's water, the water was so obviously tainted that few people drank it, even after public assurances that it was safe. In the end, child BLLs weren't significantly affected, as noted by Gómez and Kim Dietrich, who explained this in an opinion piece in the *New York Times* on July 22, 2018. In the 2018 *Pediatrics* study, Gómez and colleagues examined the results of almost 16,000 BLLs for children in Flint between 2006 and 2016 and found the number of measured BLLs above 5 µg/dL was 11.8% in 2006 and in general continuously

Layout imagery by Shutterstock.com/NikVector, ananaline

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declined, with some variations, to 3.7% in 2016. Mean BLLs were 2.33 µg/dL in 2006 and 1.15 µg/dL in 2016.

The half-life of lead in blood is about 30 days. CDC's July 1, 2016, *Morbidity and Mortality Weekly Report* for Flint (http://bit.ly/2UcWsek), from more than 9,000 samples, indicated a temporary increase from 2.5 to 4.2% (from 59 to 71) in the number of children with BLLs between 5 and 9 µg/dL after the switch to Flint River water, then a decline from 3.4 to 1.1% (68 to 37) after the change back to Detroit drinking water. The number of those children with BLLs greater than 10 µg/dL was lowered somewhat, but this may not have been statistically significant. The report notes that 53% of the blood samples were from venous blood and 46% were from capillary (finger stick) blood samples. This complicates the interpretations because skin contamination can cause capillary blood measurements to be higher than venous blood and may be less reliable than venous blood samples. According to "Interpreting and Managing Low Blood Lead Levels," a 2013 guidance for physicians from the Physicians Pediatric Environmental Health Specialty Units, initial capillary blood lead measurements greater than 4 µg/dL should be confirmed by a venous sample. It wasn't clear whether that had occurred for the data set of 9,000 samples used by CDC.

Unfortunately, the greater adverse health outcome in Flint is the likelihood that the corrosive water allowed for the mobilization of *Legionella* bacteria from biofilms and sediments, increasing the risk of legionellosis from aerosol inhalation. Sammy Zahran and colleagues, who published a report on Feb. 20, 2018, in the *Proceedings of the National Academy of Sciences* (https://doi.org/10.1073/pnas.1718679115), found that 87 cases of legionellosis and 12 deaths were reported at one point in 2014–2015 in Genesee County, Mich.

LEAD AND COPPER REGULATION

The US Environmental Protection Agency's LCR regulation was promulgated in 1991 and updated in 2000 and 2007. It requires water suppliers to regularly test for excessive corrosivity in drinking water at the tap in distribution system locations at the highest risk (50% lead service lines). Testing is performed on water that has been stagnant overnight or for at least 6 h. A 1 L first draw sample is collected, and if more than 10% of the samples exceed the lead action level of 15 µg/L or the copper action level of 1.3 mg/L, the system must introduce corrosion-control procedures and public notification. If the corrosion control isn't successful, the system must begin a lead service line replacement program of 7% per year.

The LCR action level isn't a maximum contaminant level, and it doesn't presume typical exposure. It's a benchmark screening value to indicate excessive corrosion potential for the water as tested under extreme and noncontinuous circumstances. The stagnant first-draw sample is intended to be a virtual worst case and includes water in contact with the usually leaded brass tap and some length of plumbing and solder joints, which would have high lead solder if installed before 1986 when lead solder was banned by statute.

The World Health Organization's (WHO's) 2017 *Guidelines for Drinking-Water Quality* and the European Union's (EU) drinking water directive are both 10 µg/L for lead in drinking water). Some might misinterpret this level to be more protective than the US action level. However, WHO and the EU don't require stagnant first draw water as the LCR screening test does; WHO and the EU would also allow running water sampling more typical of most daily use rather than first draw. Therefore, it's possible that routine exposure to drinking water at 10 µg/L or more could occur.

REGULATORY SUGGESTIONS

The LCR could be strengthened with minimal effort and limited cost impact by the following:

- Partial lead service line replacements that include only the public portion, but not the private segment, aren't generally recommended. In Washington, D.C., for example, lead levels peaked and then stabilized within a few weeks of public lead service line replacements. In this case, bottled water or filters should be provided to customers in the interim.
- Experience shows that expecting residents to conduct uncontrolled monitoring is difficult to arrange and has opportunities for error. Controlled on-site sampling with advance approval from residents, as by utility or health department personnel, would be more reliable. Even better, perhaps, would be to test local lead line loops in a laboratory to continuously determine the intrinsic corrosivity of the system's water.
- Sampling stagnant first-draw water is good with respect to plumbing lead. The simplest improvement would be adding a second-draw sample when the temperature change indicates that service line water is being accessed. For example, DC Water also conducted second-draw sampling, which consistently showed that phosphate corrosion control was successful. Sampling also showed a strong correlation between high iron levels from premise galvanized pipe and high lead levels.
- In apartment buildings, lead service lines often were not installed because the lead pipe capacity was too small, so first-draw stagnant samples would probably be sufficient for determining the effects on plumbing in these buildings.

The current and future LCR must be diligently applied by water utilities and properly enforced by regulators.

ADVICE TO CONSUMERS

Some recommendations for consumers to resolve their lead concerns include the following:

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- Check to see if a lead service connection exists in your home. Find where the outside incoming water line connects to the indoor meter if one is present. Ask the water supplier for a water analysis if there's any doubt.
- Don't drink the first water out of a tap, regardless of plumbing type. It will probably be warm and not taste very good, and it might have leached some material from pipes during stagnation. Let the tap water run, preferably until the temperature has changed, indicating that more distant service line water has been reached (assuming there is no lead service line).
- Don't consume anything made from first-draw water or water from the hot water tap, including baby formula, reconstituted juices, rice, pasta, boiled potatoes, and soup.
- If the home or building contains galvanized iron pipe, the water should be sampled for lead and iron. Serious consideration should be given to replace older galvanized pipe with currently approved pipe.
- Read the water supplier's annual Consumer Confidence Report and make sure the water supplier is following the law and managing corrosion.

The successful reduction of lead levels in water is a prime example of comprehensive regulations aimed at a definable problem where success and risk reduction benefits are measurable. The Flint situation raised awareness of lead issues and stimulated concerted efforts to address issues (especially in schools), although fortunately the blood lead data show that many high child exposures didn't occur. With regard to drinking water's relatively small remaining contribution to BLLs, the LCR has been successful, but there are some locations that haven't fully applied the regulation and sufficiently managed corrosion. Those who are lagging behind should realize that there's nothing to be gained and much to be lost by not fully applying the LCR to their water systems.

*—**Joseph A. Cotruvo** is the president of Joseph Cotruvo & Associates LLC in Washington, D.C. He can be reached at joseph.cotruvo@verizon.net.*

https://doi.org/10.1002/awwa.1277

ED_005190_00002051-00003

Message

From: Kempic, Jeffrey [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=274AE714CBD24F8F896B76B20B669F36-JKEMPIC]
Sent: 11/10/2016 9:56:54 PM
To: Steve Via [SVia@awwa.org]
Subject: RE: WQTC Wednesday Earlybird
Attachments: 2016 WQTC Early Bird LCR White Paper final.pptx

Steve,

I have attached the slides for my part of the presentation. See you next week.

Jeff

Jeffrey Kempic
Treatment Technology and Cost Team Leader
Standards and Risk Management Division
Phone: (202) 564-4880

From: Steve Via [mailto:SVia@awwa.org]
Sent: Tuesday, November 08, 2016 6:04 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>; Rebecca Slabaugh (Rebecca.Slabaugh@arcadis-us.com) <Rebecca.Slabaugh@arcadis-us.com>; David Cornwell (dcornwell@eetinc.com) <dcornwell@eetinc.com>; Pete D'Adamo (pdadamo@hdrinc.com) <pdadamo@hdrinc.com>
Subject: WQTC Wednesday Earlybird

Thank you for being willing to jump in and create an informative earlybird for WQTC participants on Wednesday, November 16. The earlybird is from 7:15 to 8:15 and is located in room 138-139 at the Convention Center.

The latest development in drinking water policy is the recent EPA White Paper on Revisions to the Lead and Copper Rule, so most of our allotted hour will be focused on the LCR. The conference planning committee has pointed out that health advisories for PFOS and PFOA and the recently released Health Canada Proposed Guideline for Manganese are significant for many of the attendees, so the balance of our hour will go to those topics.

My proposal … for your abuse is the following:

1. Introduction – Via (less than 15 minutes, goal is 10 minutes, 4 – 5 slides)
    a. EPA is finalizing the Drinking Water Action plan, and repeat its themes
        i. Including health advisories like those for PFOS and PFOA
        ii. If you have not seen it, take a look at the draft Health Canada Guideline for Manganese
        iii. Think about the guideline in terms of UCMR4 and distribution system operations
    b. Revising the LCR is certainly part of the plan and EPA just released the White Paper, resetting the vision for what drafting the proposal really entails
        i. Jeff Kempic is here to provide an overview of the issues EPA is considering
    c. I've also asked Dave, Rebecca, and Pete to participate in today's earlybird to share the kinds of questions and issues utilities are bringing forward as they begin to respond to EPA's guidance on the current LCR, plans for the upcoming revisions, and respond to the recent health advisories.

2. LCR White Paper – Kempic (roughly 15 minutes)
    a. Key points in the white paper like
        i. The individual elements of the rule need to fit together effectively
        ii. Focus on OCCT
        iii. Role of sampling
        iv. Use of filters
        v. …

3. Insights Gleaned from Working with Utilities (Balance of the Session)
    a. Taking on re-evaluating OCCT in preparation for change … new sources, new treatment
    b. Questions states are asking (that systems are finding hard to craft responses)
    c. How do you set treatment performance when public is being guided by a health advisory
    d. [What questions are most important that we put out there for audience that will motivate them to go home and think about what they need to do?]
    e. Balance of time left to audience questions.

Steve Via
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Lead and Copper Rule Revisions White Paper – October 2016

Jeffrey Kempic

Early Bird Session

Water Quality Technology Conference

November 16, 2016

Key Principles for LCR Revisions

- Focus on Minimizing Exposure to Lead in Drinking Water
- Clear and Enforceable Requirements
- Transparency
- Environmental Justice and Children's Health
- Integrating Drinking Water with Cross-Media Lead Reduction Efforts

Summary of Current LCR

- The LCR requires compliance with a treatment technique rather than a Maximum Contaminant Level (MCL)
- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- Tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L
  - Copper - 1.3 mg/L
- Action levels are a screen for implementing optimal corrosion control (systems < 50,000 people) as part of the treatment technique.
- Lead action level exceedance (ALE) also triggers public education (PE) and lead service line replacement (LSLR)

Key Challenges of the Current LCR

- LCR is complicated rule
  - Controlling corrosivity of water through antiquated distribution and plumbing systems to consumer's tap
  - Only rule with sampling in homes, often by the customers themselves, and homes must meet targeting criteria
  - Requires expertise at State and system level to identify system-specific optimal corrosion control treatment (CCT) and monitoring to assure effective operation
- Stakeholder Input
  - National Drinking Water Advisory Council – including dissenting opinion
  - Flint Water Interagency Coordinating Committee & others

National Drinking Water Advisory Council Recommendations (NDWAC)

- December 2015 Key Recommendations
  - Proactive LSLR – not triggered by ALE
  - More robust PE for lead – not triggered by ALE
  - Strengthen CCT – reassess as EPA updates OCCT guidance
  - Modify monitoring – customer requested – use to inform customer & assess effectiveness of CCT
  - Tailor water quality parameters (WQPs) to specific CCT
  - Household action level (HAL) – triggers a report to customer & health agency for follow-up
  - Separate copper requirements from lead

LSLR - Key Issues/Considerations

- EPA is evaluating:
  - Appropriate pace of LSLR and mechanism for implementing and enforcing LSLR program requirements
  - Costs and benefits of LSLR for reducing lead exposures. National costs could range between $16 to $80 Billion. Benefits will be based on avoided effects of lead exposure.
  - How to provide full LSLR when system does not own entire line, including potential change to definition of "control"
  - How to address equity concerns and ability to pay for LSLR – potential for incentives, using DWSRF
  - Whether to prohibit or limit partial LSLR and how to address LSL disturbances

Improved Optimal Corrosion Control Treatment

- Options under consideration include:
  - Require systems > 50,000 people to evaluate and re-optimize CCT when EPA publishes updated CCT guidance
  - Requiring all systems to implement CCT, regardless of system size, tap sampling results or the presence of LSLs
  - Broadening the categories of systems for which CCT is required
  - Requiring all water systems to assume its distribution system contains LSLs until robust material evaluation demonstrates this is not the case
  - Require re-optimization of CCT when lead AL is exceeded

Health Based Benchmark

- Incorporating a health based benchmark to strengthen protection
  - MCLG = 0 for lead – no safe level of lead
  - NDWAC recommendation – household action level (HAL)
    - Lead level in drinking water that would raise average infant's blood lead > 5 µg/dL based on formula consumption
    - Water system notifies individual and public health agency of results when level is greater than HAL
  - EPA is developing models of relationship between water lead levels and blood lead levels in children
  - Expert peer review of the modeling approaches
  - Determination about the role of a health based value

Point of Use Filters

- Potential Role
  - Work in Flint has demonstrated efficacy of POU devices in reducing lead at the tap, even with high influents
  - POU for compliance under SDWA requires system or someone under contract to own, control and maintain the POU units, which may limit this as a system-wide approach, especially for larger systems
  - POU could be required where there has been a disturbance of a LSL or where tap sampling indicates an exceedance of a health-based or other benchmark

Sampling Requirements

- Current LCR – February 29, 2016 Memorandum
  - Eliminate pre-flushing and faucet aerator removal prior to conducting lead and copper tap testing at a location
  - Encourage use of wide-mouth bottles
- Evaluations for LCR Revisions
  - What is the appropriate sampling protocol – first draw, sequential, random daytime? Should it vary by site? Can it be implemented by customers?
  - Should schools be included in the sampling being conducted by community public water systems (schools that are PWS already covered by LCR)
  - Can real-time monitoring technologies be developed?

Increased Transparency & Information Sharing

- Requirements under consideration:
  - Requiring PWS to post LCR sampling results while protecting privacy of customers
  - Mandating shorter timeframes for providing results
  - Mandating ongoing PE
  - Requiring systems to make publicly available locations of LSLs within distribution system
  - Requiring states to identify systems with ALE and the specific steps being taken to address it
  - Requiring systems to provide more detail on lead tap sampling, results above AL, invalidation and voluntary results not used for AL

Public Education – LSL Sites

- NDWAC discussed targeted PE for sites with LSLs and EPA is considering
  - Requiring systems as part of the targeted outreach to invite the customers to have their water tested and participate in LSLR program
  - Requiring systems to provide public access for LSL inventories (site locations)
  - Requiring customers to be notified of emergency or planned maintenance that may disrupt LSLs and actions that can mitigate potential lead increases
  - Requiring a standard operating procedure be provided to other utilities that may disturb LSLs

Potential Revised Copper Requirements

- EPA is considering:
  - Modification of sample site selection criteria to include sites at greatest risk of elevated copper
  - Developing water quality parameters designed to identify systems that have aggressive water to copper
  - Systems with aggressive water could be required to install CCT and/or conduct PE for copper
  - Systems with non-aggressive water could be required to periodically monitor to demonstrate that copper leaching is not a concern

Message

From: Kempic, Jeffrey [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=274AE714CBD24F8F896B76B20B669F36-JKEMPIC]
Sent: 10/22/2018 3:08:31 PM
To: Alex Hauger [AHauger@awwa.org]
Subject: RE: WQTC18 Presentation
Attachments: 2018 WQTC LCR Update Cover Page.pptx; AWWACreativeCommonsForm - JK.pdf

Alex,

I have attached the Creative Commons signature form and the cover page slide from the presentation. I will keep pressing here to get the presentation approved. Thanks.

Jeff

Jeffrey Kempic
Treatment Technology and Cost Team Leader
Standards and Risk Management Division
Phone: (202) 564-4880

From: Alex Hauger [mailto:AHauger@awwa.org]
Sent: Thursday, October 18, 2018 5:04 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Subject: Re: WQTC18 Presentation

Hi Jeff,

I have attached a copy of the Creative Commons Form required for the presentation to this email. If you could, please complete section 3 on the first page, complete the signature portion on the second page, and fill in your presentation title on the second page as well.

While having the final presentation by next week will be fine, we are needing to upload something at this point. Do you think you could send a draft, or if that is not acceptable a simple title slide I can upload as a placeholder? That would satisfy our system and make sure everything is set.

Let me know what you think, and if you can get the files to me today, that would be ideal. I do apologize for needing these items so quickly as I know you most likely have many other things to do at this time as well.

Best regards,

Alex Hauger

Coordinator 2 - Presenters
Direct 303.347.6123
ahauger@awwa.org | www.awwa.org

From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Thursday, October 18, 2018 2:53:29 PM
To: Alex Hauger
Subject: RE: WQTC18 Presentation

Alex,

Since the conference is taking place in Canada, it seems like every step in the process has had numerous added steps, like getting a diplomatic passport for some reason, including the internal review for the presentation. With the current version of the talk, I hope to have that complete by the end of next week.

Can you resend the form AI need to sign – I am swamped with unopened emails and that will probably be faster than trying to find it by digging through them.

Hope that helps give you a status update.

Jeff

Jeffrey Kempic
Treatment Technology and Cost Team Leader
Standards and Risk Management Division
Phone: (202) 564-4880

From: Alex Hauger [mailto:AHauger@awwa.org]
Sent: Wednesday, October 17, 2018 1:35 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Subject: WQTC18 Presentation

Hi Jeff,

I wanted to connect with you in regards to your WQTC18 presentation titled: "Update on the US Lead and Copper Rule and Summary of Outcomes from Federalism Meetings".

It appears we have not received the required files to present at this point. We require a signed Creative Commons Form as well as a presentation file to be uploaded. I am showing that neither of these files have been received.

As these files are past due, there is now a chance your presentation may be cancelled. If I do not receive the files by the end of the day, I will have to let our team know they are missing and they will determine if we need to find replacement presenters. I should note that you do not have to have the finalized presentation file at this point. If you can upload a draft, or even a place holder title slide, that would be enough at this point.

If you have any questions, please contact me at 303.347.6123

Best regards,

Alex Hauger

Coordinator 2 - Presenters
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US EPA Update: Lead and Copper Rule – Federalism Consultation

Jeffrey Kempic

Special Topic Session 6

Water Quality Technology Conference

November 14, 2018

Summary of Current LCR

- The LCR requires compliance with a treatment technique rather than a Maximum Contaminant Level (MCL)
- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- Tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L
  - Copper - 1.3 mg/L
- Action levels are a screen for implementing optimal corrosion control (systems < 50,000 people) as part of the treatment technique.
- Lead action level exceedance (ALE) also triggers public education (PE) and lead service line replacement (LSLR)

Key Challenges of the Current LCR

- LCR is complicated rule
  - Controlling corrosivity of water through antiquated distribution and plumbing systems to consumer's tap
  - Only rule with sampling in homes, often by the customers themselves, and homes must meet targeting criteria
  - Requires expertise at State and system level to identify system-specific optimal corrosion control treatment (CCT) and monitoring to assure effective operation
- Other challenges
  - Structure only compels protective actions after public health threats have been identified
  - Limited focus on schools (only those that are PWS)

Stakeholder Consultations

- National Drinking Water Advisory Council – including dissenting opinion – December 2015
- Science Advisory Board Evaluation of the Effectiveness of Partial Lead Service Line Replacements – September 2011
- Stakeholder Meeting on Potential Long-Term Revisions – November 2010
- Tribal Consultations – 2011
- Environmental Justice - 2011

Federalism Consultation Process

- Required under Executive Order 13132
  - Consult State and local government organizations or their representative national organizations when developing regulations that impose substantial compliance costs on them
  - Initial meeting – January 8, 2018 – started the 60-day comment period for groups to submit comments
  - Initial meeting attended by 17 intergovernmental organizations

Tribal Consultation Process

- Required under Executive Order 13175
  - Consultation with federally recognized tribes initiated on January 16, 2018 and ended on March 16, 2018
  - Two national webinars held on January 31 and February 15, 2018
  - Total of 48 tribal representatives participated in the two webinars

Key Areas for Rule Revisions Discussed In Federalism and Tribal Consultations

- Lead Service Line Replacement
- Corrosion Control Treatment
- Tap Sampling
- Public Education and Transparency
- Copper Requirements

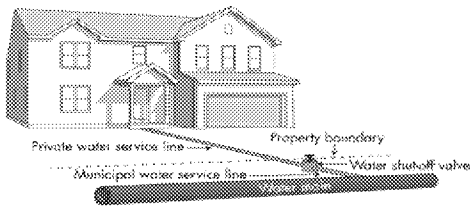
Lead Service Line Replacement

Current Requirements

- Systems that exceed the lead Action Level (AL) after installing corrosion control treatment (CCT) must replace 7% of lead service lines per year (the state can accelerate)
- Systems are only required to replace portion of the LSL owned by the PWS
- Systems may consider an LSL replaced if a sample from that line is below the AL
- Systems must offer to replace customer owned portion at customer cost
- LSLR can stop when lead <=AL for 2 consecutive monitoring periods

Challenges

- Most homeowners have declined the opportunity to replace their portion of the lead service line.
- Partial replacements may be harmful due to the disruption of the service line dislodging lead



Lead Service Line Replacement Key Questions

- What are the opportunities and challenges to state and local governments if EPA were to modify the LCR to:
  - Require systems to create an inventory of lead service lines
  - Require proactive full lead service line replacement on a specified schedule (e.g., 10, 15, 25, 35 years from promulgation)
  - Allow partial LSLR only for emergency repair or "unwilling or unable customers" when conducting infrastructure replacement (e.g., main replacement)
  - Require pitcher filters to be distributed and regularly maintained by the PWS for three months immediately following lead service replacement

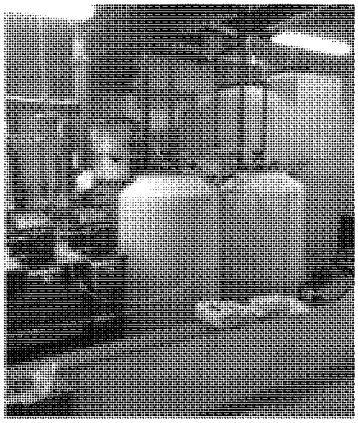
Corrosion Control Treatment

Current Requirements

- Systems serving >50,000 required to perform CCT
- Systems serving ≤50,000 required to perform CCT <u>if</u> AL exceeded
- System proposes treatment (or changes) and state approves

Challenges

- States and water systems often lack needed expertise
- Some small systems with lead service lines are not required to perform CCT



Corrosion Control Treatment Key Questions

- What are the opportunities and challenges to state and local governments if the LCR was modified to:
  - Target systems to required install CCT differently:
    - Change the current system size threshold (50,000 people served), or
    - Require systems with lead service lines (regardless of population served) to install and maintain CCT?
  - Require plumbed in point of use treatment devices to be provided to households with lead service lines and regularly maintained
  - Change the requirements for designating optimal CCT to:
    - Prescribe a default CCT that must be maintained unless a system can demonstrate equivalent CCT to the state, or
    - Require the system to conduct a periodic re-evaluation of CCT to be reviewed by the state?
  - Require system to find and fix problems in corrosion control treatment if a tap sample exceeds an action level?

Transparency & Public Education

Current Requirements

- The annual Consumer Confidence Report sent to all consumers must include lead sampling results and an informational statement about the health effects of lead and actions to reduce exposure
- Systems that exceed lead action level must begin public education within 60 days after end of monitoring period:
  - Educational materials must include information on health effects of lead, sources of lead, and steps consumers can take to reduce exposure to lead in drinking water
- The 2016 Water Infrastructure Improvement for the Nation Act (WIIN) requires notice of exceedance of AL within 24 hours

Challenges

- Intensive public education only occurs after a problem has been identified
- Information on lead in drinking water is confusing, particularly results in comparison to the action level

Transparency & Public Education: Key Questions

- What do state and local governments think are the most effective ways for water systems to deliver educational information to consumers?
- What opportunities and challenges would state and local governments face if the LCR was revised to require:
  - Water systems to provide on-going targeted outreach with a special emphasis on all customers with lead service lines?
  - Water systems to provide notification to consumers within 24 hours of exceeding an action level (as required by the 2016 WIIN Act)?
  - Water Systems to make information accessible to consumers on results of all tap sampling, results of water quality parameter (WQP) monitoring and the number and locations of LSLs?

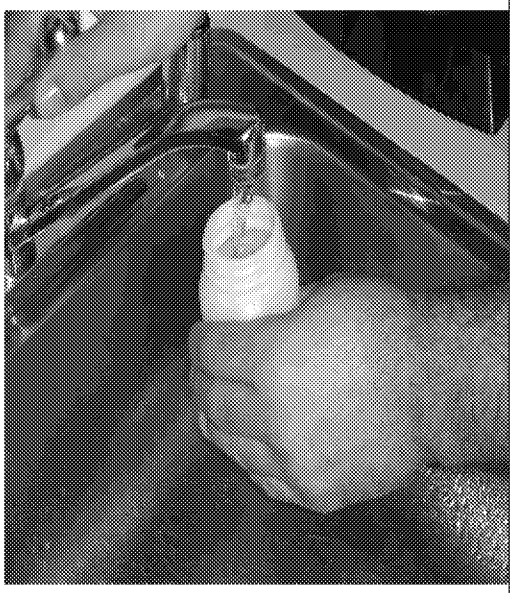
LCR Tap Sampling

Current Requirements

- Collect samples at residential taps that are at high risk of lead contamination
- 90th Percentile result compared to Action Levels based on treatment feasibility
  - 15 ppb (µg/L) lead
  - 1.3 ppm (mg/L) copper

Challenges

- Complicated sampling procedure
- Procedures are not always followed
- Up to 10% of samples can have highly elevated levels of lead with no additional requirement for actions



Tap Sampling: Key Questions

- What are the opportunities and challenges for states and local governments if the rule changed sampling protocols, including:
  - Changing where water systems are required to collect tap samples?
    - At sites based on customer request,
    - At schools served by the system,
  - Change the way samples are collected to be more representative of exposure?
    - Increase the number of samples required
    - Instruct consumers to sample when they are drawing water for drinking or cooking.
  - Establish a household action level that if exceeded would trigger a report to the consumer and to the applicable health agency for follow up?

Copper

Current Requirements

- Copper samples are collected at the same time and customer taps as lead samples.
- The 90th% value of results is compared to the copper AL of 1.3 mg/L.
- If the copper AL is exceeded, water systems must implement CCT.

Copper Revisions
Key Questions

- What opportunities and challenges would state and local governments face if EPA revised the LCR to:
  - Establish a screen to determine if water systems have water aggressive to copper?
    - If water is aggressive, require:
      - monitoring and/or
      - public education and/or
      - CCT.
  - Modify tap sampling to require separate sampling sites for copper?

How Does it All Fit Together?

- The LCR is a composite of multiple requirements that apply to systems differently depending on system size and water quality
- The revised LCR would similarly bring together multiple key requirements that could vary according to system specific conditions
- One important factor in considering potential changes to the LCR is cost. The following slides provide representative examples of the costs of a few key potential requirements

Example Costs for Key Potential Requirements

Lead Service Line Replacement

- Based on preliminary estimates, replacing a full LSL would cost on average $4,700 per line replaced
- Cost can vary greatly depending on the length and the amount of pavement that must be restored. Costs may range from $1,200 - $12,300 per line replaced

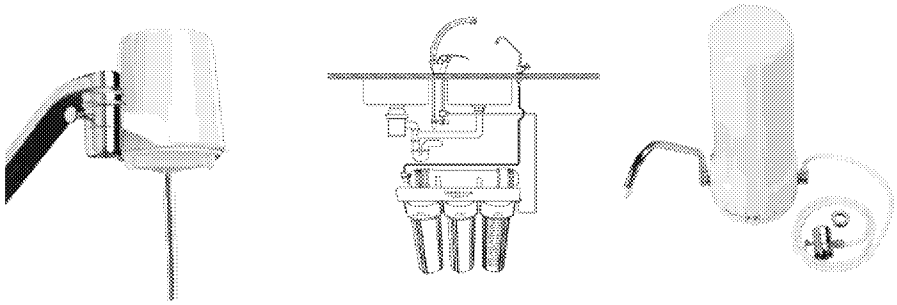
Example Costs for Key Potential Requirements

Estimated Costs for Centralized Orthophosphate Treatment (CCT) Systems				
Public Water System Size (People Served)	Total System Capital Cost ($)	Annual System O&M Cost ($)	Total Capital Cost per Household ($)	Annual O&M Cost per Household ($)
25-100	18,000	2,000	740	78
100-500	19,000	2,000	170	21
500-1000	21,000	3,000	72	12
1000-3300	22,000	6,000	31	8
3300-10000	39,000	8,000	17	3
10000-50000	48,000	25,000	5	3
50000-100000	63,000	81,000	2	3
100000-500000	92,000	265,000	1	2

In this table total system and household capital costs are one time costs and are not annualized values. Annualized capital cost would normally be calculated over the useful life of the technology.

Example Costs for Key Potential Requirements

- Plumbed in Point of Use filter devices would have an estimated total annual cost of $120 per household



Federalism/Tribal Consultations

- Received a total of 91 comments from the two consultation processes
- Docket for the comments can be found at:
  - https://www.regulations.gov/docket?D=EPA-HQ-OW-2018-0007
- EPA is assessing the comments as it prepares a revised lead and copper rule proposal

Questions?

Message

From: Kempic, Jeffrey [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=274AE714CBD24F8F896B76B20B669F36-JKEMPIC]
Sent: 1/31/2020 8:47:38 PM
To: Jonathan Davis [jdavis@csg.org]
CC: Lisa Janairo [ljanairo@csg.org]
Subject: RE: Monday's GLLC webinar
Attachments: BIO FOR GLSLLC 2020.doc; TechnicalBrief_LCR Proposed Revisions_12.18.19.OGWDW.pptx

Jon,

I have attached a copy of the slides and a brief bio – modified from the one I sent to AWWA WQTC – the bio has two lengths, so feel free to use either one. No luck so far on solving the IT issue. It could not be solved remotely and not sure if they will come today. May make it a little more challenging on Monday.

Jeff

From: Jonathan Davis <jdavis@csg.org>
Sent: Thursday, January 30, 2020 3:22 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: RE: Monday's GLLC webinar

Jeff,

That works for us, and thanks for your availability. Lisa is about to send out a meeting invitation, so we'll look forward to chatting with you tomorrow morning.

Jon

From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Thursday, January 30, 2020 2:14 PM
To: Jonathan Davis <jdavis@csg.org>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: RE: Monday's GLLC webinar

[EXTERNAL EMAIL]

How about 11:00 Eastern time?

Jeff

From: Jonathan Davis <jdavis@csg.org>
Sent: Thursday, January 30, 2020 2:58 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: Monday's GLLC webinar
Importance: High

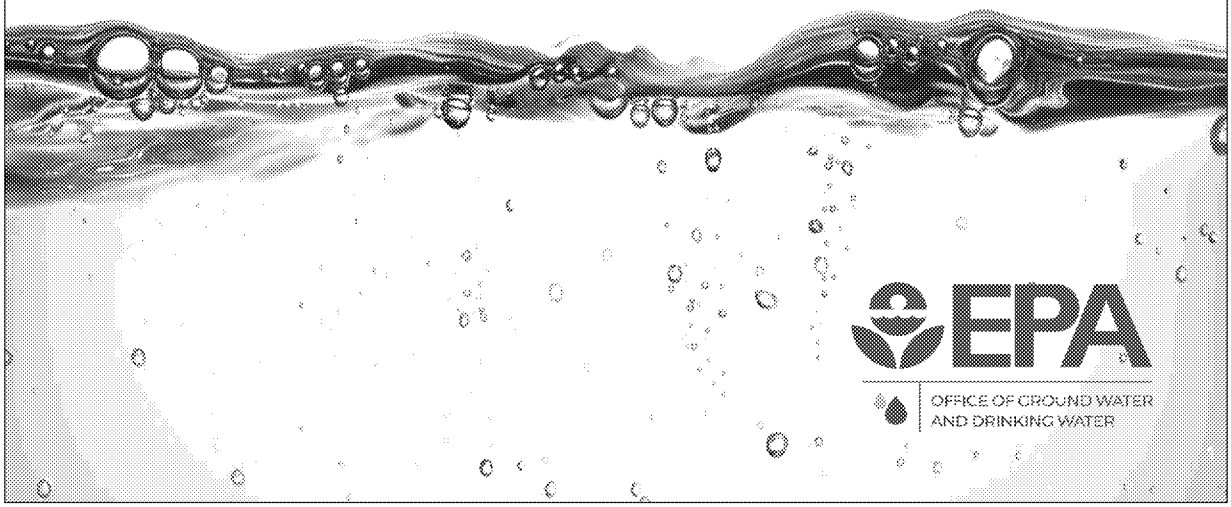
Jeff

In preparation for Monday's webinar, do you have time tomorrow between 10 a.m. and 3 p.m. Eastern for a brief (15-minute) call with Lisa Janairo and I to go over the setup in GoToMeeting?

Jon Davis | Policy Analyst | Assistant Editor
The Council of State Governments, Midwestern Office
701 East 22nd Street, Suite 110 | Lombard, IL 60148
phone: 630.925.1922
www.csgmidwest.org

Proposed Lead and Copper Rule Revisions

Version: December 18, 2019



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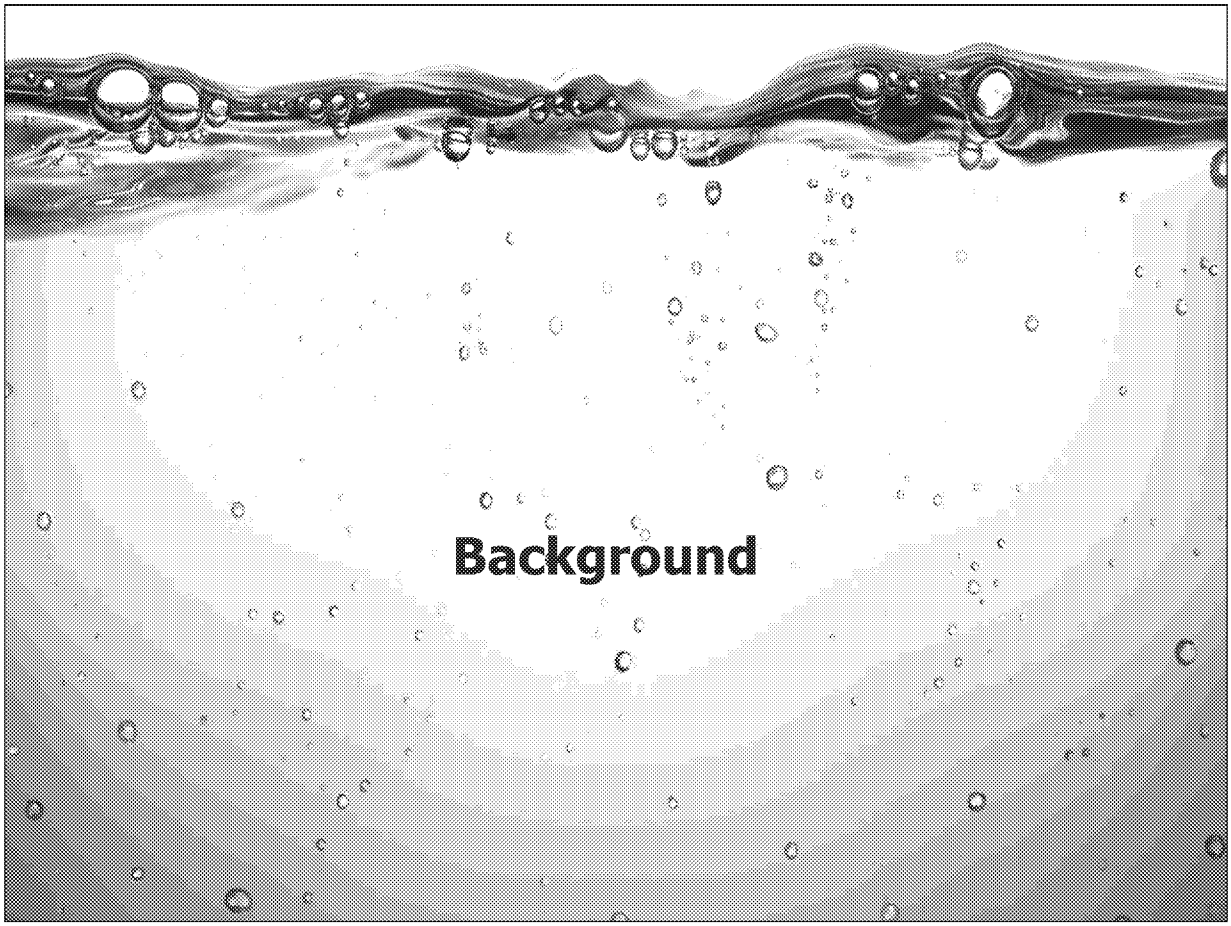
Agenda

- Proposed Revisions Highlights
- Background
- Overview of the Proposed Rule
- Key Requirements and Proposed Revisions
- Additional Information
- Questions

Proposed Revisions: Highlights

- Takes a proactive and holistic approach to improving the current rule—from testing to treatment to telling the public about the levels and risks of lead in drinking water
- Requires earlier action to reduce risks and better protect families
- Includes efforts to improve transparency and communication to help protect children from lead exposure where they live, learn and play


Background

Overview: Current Lead and Copper Rule (LCR)

- Lead is not naturally found in water
- Lead from lead pipes, faucets, and fixtures can dissolve into water or sometimes can enter as flakes or small particles
- To keep lead from entering the water, EPA requires some systems to treat water using certain chemicals that keep the lead in place by reducing corrosion
- When corrosion control alone is not sufficient to control lead exposure, EPA requires systems to educate the public about risks of lead in drinking water and to replace lead service lines

Overview: Current LCR

- LCR was promulgated 1991, revised in 2000 and 2007
- Applies to 68,000 community (CWS) and non-transient non-community (NTNCWS) public water systems serving ~300 million people
- EPA is continuously working with primacy agencies to ensure that the LCR is being properly implemented

Overview: Current LCR

- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L (ppb)
  - Copper - 1.3 mg/L (ppm)

Proposed Revisions: Development

- EPA has conducted extensive consultations regarding potential LCR revisions including:
  - Science Advisory Board
  - National Drinking Water Advisory Council
  - State, Local and Tribal officials
- Based upon this input and experience implementing the LCR, EPA has developed revisions that target actions to reduce lead exposure where it is needed most
- The proposed rule will identify the most at-risk communities and ensure systems have plans in place to rapidly respond by taking actions to reduce elevated levels of lead in drinking water

Proposed Revisions: Summary

- The proposed LCR maintains the current MCLG of zero and AL of 15 ppb but requires a more comprehensive response at the action level and introduces a trigger level of 10 ppb
- The trigger level is a new flexible provision designed to compel water systems to take progressive, tailored actions to plan upgrades to aging infrastructure and reduce levels of lead in drinking water
- This approach focuses on six key areas

Proposed Revisions: Key Areas

1. Identifying areas most impacted
2. Strengthening treatment requirements
3. Replacing lead service lines
4. Increasing sampling reliability
5. Improving risk communication
6. Protecting children in schools

Proposed Revisions: Key Area 1

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Identifying Areas Most Impacted

- The EPA will for the first time require systems to develop a public lead service line inventory and create a plan for removing lead service lines
- Unlike now, systems will have to pay attention to individual locations with elevated levels of lead by identifying the cause and mitigating the problem (find & fix)

Proposed Revisions: Key Area 2

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Strengthening treatment requirements

- Based on sampling results, systems with elevated lead levels will reevaluate their existing corrosion control treatment or conduct a treatment study so that they are prepared to respond quickly when necessary
- Flexibility is important for small systems so that they can protect public health by taking the action that makes sense for their community

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines

- Systems above the trigger level of 10 parts per billion would be required to work with their state to set an annual goal for replacing lead service lines
- Water systems above 15 parts per billion would be required to fully replace a minimum of three percent of the number of known or potential lead service lines annually

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines, continued

- Importantly, the proposal prohibits "test-outs" to avoid replacing lead service lines – an allowed practice under the current rule that has significantly slowed national progress in removing this significant source of lead from our homes
- Partial lead service line replacements will no longer be allowed except in certain situations (e.g., emergency repair) because science has recently shown us that partial lead service line replacement may increase short-term lead exposure

Proposed Revisions: Key Area 4

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Increasing Sampling Reliability

- Water systems will follow new, improved sampling procedures, will adjust sampling sites to better target locations with higher lead levels, and systems with higher levels will sample more frequently

Proposed Revisions: Key Area 5

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Improving Risk Communication

- Homeowners will learn about elevated levels of lead in their system sooner
- They will also understand where lead services lines are in their community and how to protect their family from exposure to lead

Proposed Revisions: Key Area 6

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Protecting Children in Schools

- For the first time, systems will be required to test school and child care facilities
- The system would be required to provide the results and information about the actions the school or child care facility can take to reduce lead in drinking water

Proposed Revisions Details

Current LCR: Action Level

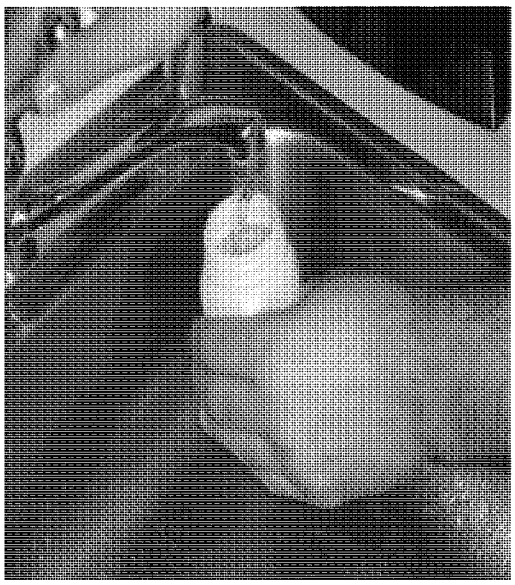
- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L
  - Copper - 1.3 mg/L

Proposed Revisions: Lead Trigger Level

- Propose a new Lead Trigger Level (TL) of 10 µg/L
- TL is in addition to the lead action level (AL) of 15 µg/L
- Water systems that exceed the TL but not the AL:
  - No reduced tap sampling, annual at standard number of sites
  - Implement goal based LSLR program
  - Annual outreach to LSL customers
  - CCT study if CCT not installed
  - Re-optimize if CCT is installed

Current LCR: Tap Sampling

- All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are subject to monitoring requirements
- Systems must collect first-draw samples at taps in homes/buildings that are at high risk of lead and copper contamination



Current LCR: Tap Sampling, continued

- The number of required samples varies by the size of the population served by the system, from 100 samples for large systems serving over 100K people down to 5 samples for systems serving 100 or fewer people
- Systems must conduct monitoring every 6 months unless they qualify for reduced monitoring
- The number of required samples and sampling frequency may be reduced if systems meet certain requirements
- Systems were required to perform a materials evaluation to identify a pool of targeted sampling sites

Proposed Revisions: Tap Sampling

- Lead Service Line Inventory: Require all water systems to create an inventory of lead service lines and update it annually
- Tap sample site selection criteria (tiering)
  - Revise the tap sample site tiering criteria to emphasize sampling from LSL sites
  - Recategorize all copper pipe with lead solder sites regardless of age
- 90th percentile calculation for lead
  - Water systems with LSLs would use 100% tap samples from LSL sites
  - Water systems with insufficient numbers of LSLs collect samples from LSL and non-LSL sites would use the highest non-LSL tap samples
  - Water systems without LSLs would use all tap samples collected

Proposed Revisions: Tap Sampling, continued

- Tap sample collection protocol
  - Prohibit systems from including sampling instructions to remove and clean aerators or to conduct pre-stagnation flushing prior to the start of the required stagnation period
  - Systems must supply samplers/consumers with wide-mouth bottles to collect a tap sample
- Monitoring
  - Systems above the Trigger Level must monitor at least annually (not eligible for reduced triennial monitoring)

Current LCR: Corrosion Control Treatment

- Systems serving > 50,000 people required to begin optimized corrosion control (OCCT) 1994-1998
- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL
  - Systems make optimal corrosion control recommendation to State
  - State approves or designates alternative
  - Follow-up monitoring conducted for one-year

Current LCR: Corrosion Control Treatment, continued

- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL, continued
  - State reviews data and designates optimal water quality parameters (OWQP)
  - Systems maintain OWQP
  - Systems compliance with the treatment technique is based on OWQP AL is exceeded
  - Small/medium systems can discontinue if they meet AL in two consecutive monitoring periods

Proposed Revisions: Corrosion Control Treatment

- Require water systems with OCCT to re-optimize if the 90th percentile lead level exceeds the TL or AL
- Require water systems without OCCT to study OCCT if the 90th percentile exceeds the TL and implement OCCT if the AL is exceeded
- Revise sanitary survey requirements for water systems to include CCT review and WQP assessment, including relevant updated guidance that has been issued by the EPA

Proposed Revisions: Corrosion Control Treatment, continued

- Specify that systems should evaluate an orthophosphate-based inhibitor as CCT (instead of a phosphate-based inhibitor) as part of the CCT study
- Establish additional specifications for water systems to study alternative CCT
- Require systems to conduct "find-and-fix" for individual sites that exceed the AL (See next slide)

Proposed Revisions: Find-and-Fix

- Require all systems to collect a follow-up sample for each lead tap sample site that exceeds 15 µg/L and require systems to subsequently implement a "find-and-fix" approach
- Systems must collect follow-up tap samples within 30 days of learning the results
- Systems would be required to report the results to the state, but the results would not be included in lead 90th percentile calculations

Proposed Revisions: Find-and-Fix, continued

- Systems with CCT would be required to collect an additional WQP sample at or near the site where the high lead sample was collected within 5 days of learning of the lead results
- Systems must determine if a CCT "fix" is needed (e.g., localized CCT change and/or a systemwide CCT change, spot flushing, distribution system operation improvements, system looping and other strategies to reduce dead ends)
- Systems that identify a fix that is out of their control, such as a customer that does not want an old brass faucet replaced, must provide documentation to their state

Current LCR: Notifications & Public Education

- The annual Consumer Confidence Report (CCR) sent to all consumers must include lead sampling results and an informational statement about the health effects of lead and actions to reduce exposure
- Public Notification sent to all consumers if water system has a violation of the treatment technique within 30 days; and notice of violation for failure to monitor or report results within one year

Current LCR: Notifications & Public Education, continued

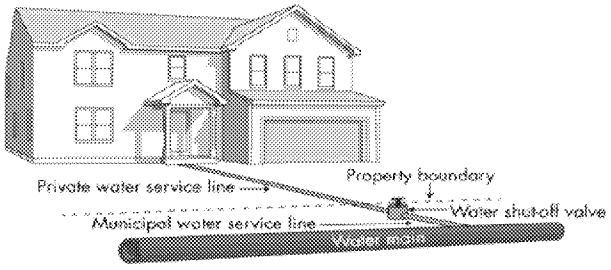
- Systems that exceed the lead action level must begin public education within 60 days after the end of monitoring period:
  - Educational materials must include information on health effects of lead, sources of lead, and steps consumers can take to reduce exposure to lead in drinking water
- Water systems send lead consumer notice with tap sample result to homes where a tap sample is collected within 30 days
- Note that the 2016 Water Infrastructure Improvement for the Nation Act (WIIN) requires notice of a 90th percentile lead level exceeding the AL within 24 hours

Proposed Revisions: Notification and Public Education

- Revise CCR mandatory health effects language and require reporting of the range of tap sample levels in addition to the 90th% and number of samples greater then the lead AL
- Water systems must conduct public notification to consumers within 24 hours of a 90th percentile lead level > AL (WIIN Act)
- Provide notice to customers whose individual tap sample is > 15 µg/L within 24 hours
- Require water systems with LSLs that exceed the TL to conduct annual outreach to LSL customers
- Deliver Public Education (PE) to impacted consumers during water-related work that may disturb LSLs
- Provide public access to LSL inventory

Current LCR: Lead Service Line Replacement

- Systems that exceed the lead Action Level (AL) after installing corrosion control treatment (CCT) must replace 7% of lead service lines per year
- Systems are only required to replace the portion of the LSL owned by the PWS
- Systems may consider an LSL replaced if a sample from that line is below the AL
- Systems must offer to replace customer owned portion at customer cost
- LSLR can stop when lead ≤ AL for 2 consecutive monitoring periods



Proposed Revisions: Lead Service Line Replacement (LSLR)

- Water systems with LSLs would prepare an LSLR program plan and establish an LSLR goal rate with state approval
- Water systems must replace public portion of LSL when customer notifies them of replacement of private portion
- Water systems that exceed the lead TL, but not the AL, would implement the goal based LSLR program
  - Water systems can stop goal based LSLR when system is below the TL for 2 consecutive monitoring periods

Proposed Revisions: Lead Service Line Replacement (LSLR), continued

- Water systems that exceed the lead AL would replace annually 3% of LSLs
  - Water systems can stop 3% annual LSLR when system is below the AL for 4 consecutive monitoring periods
- All LSLR will be full replacements
  - Partial LSLR only for emergency repair or "unwilling or unable customers" when conducting infrastructure replacement (e.g., main replacement)
- Removes the "test out" provision
- Require pitcher filters to be distributed and replacement cartridges by the PWS for three months immediately following lead service replacement

Proposed Revisions: Lead Service Line Replacement (LSLR)

Proposed LCRR:
Requires 3% annual LSLR when lead action level is exceeded

- The entire LSL must be replaced to count towards 3% annual LSLR
- LSLR can stop after **4** monitoring rounds ≤ AL

Trigger Level:

- The entire LSL must be replaced to count towards goal LSLR rate approved by the state

Current LCR:
Requires 7% annual LSLR when lead action level is exceeded

- Allows system to replace only the water system portion of the LSL
- Allows systems to test LSLs and count as replaced if samples are ≤ 15 ppb
- Both of the above allow systems to meet 7% annual LSLR while leaving portions or entire LSLs in place
- LSLR can stop after **2** monitoring rounds ≤ AL

There is no trigger level requiring LSLR

Proposed Revisions: Small System Flexibility

- Applies to CWSs serving 10,000 or fewer persons and all NTNCWS
- Compliance alternatives for small CWSs:
  - full lead service line replacement
  - installation and maintenance of optimized corrosion control treatment, and
  - installation and maintenance of point-of-use (POU) devices

Proposed Revisions: Small System Flexibility, continued

- Compliance alternatives for NTNCWSs:
  - same alternatives as above, and
  - replacement of all lead bearing plumbing fixtures at every tap where water could be used for human consumption
- Water systems with a lead TL would recommend a compliance option and obtain Primacy Agency approval
- If a water system subsequently exceeds the lead AL it must implement the approved option

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

Community Water Systems would

- Develop a list of customers or service connections that provide water to schools or licensed child care providers and verify this list every five years
- Each year, a CWS would collect samples at 20 percent of schools and 20 percent of child care facilities from the list. Therefore, a CWS would collect samples at each facility once every five years
- For each child care facility: collect two samples
- For each school: collect five samples

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

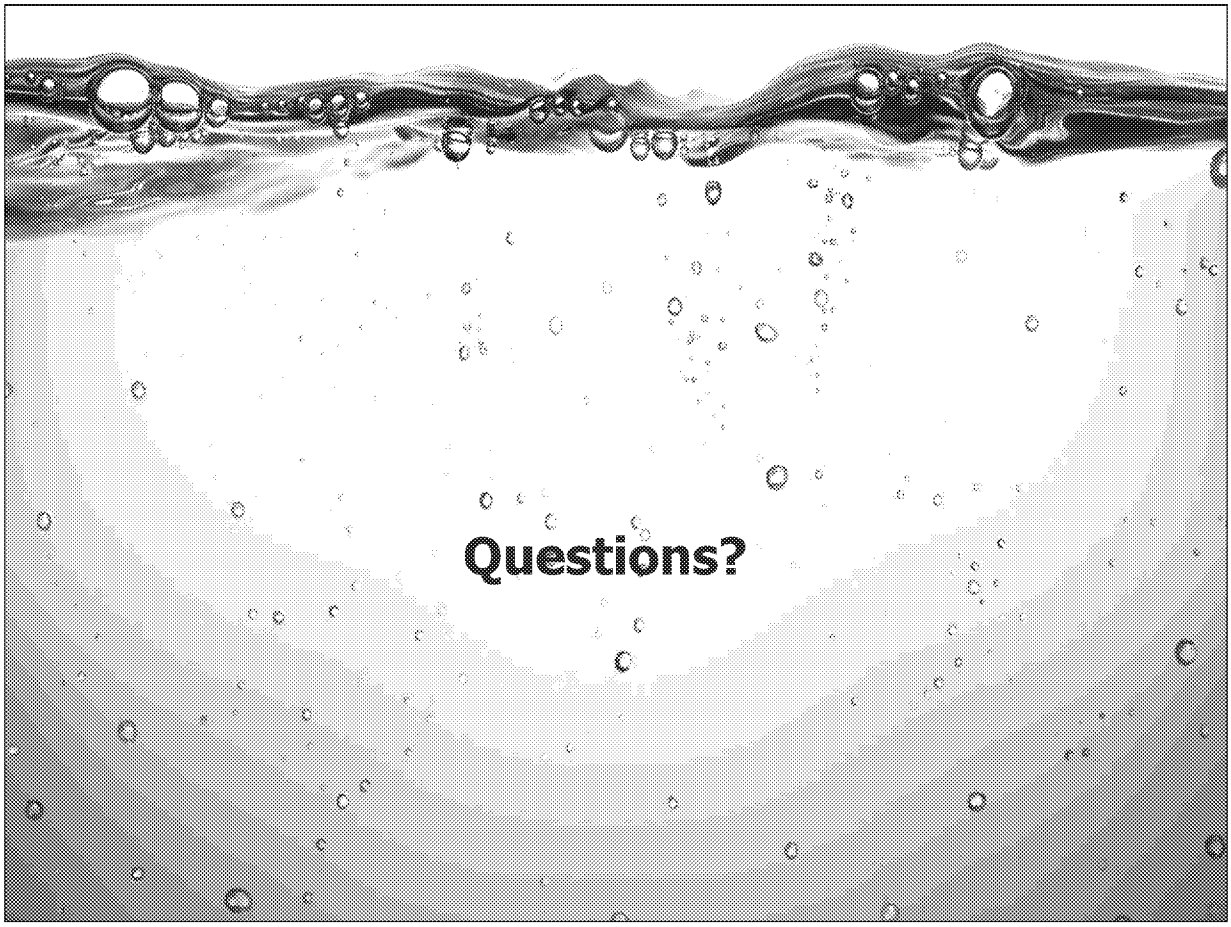
Community Water Systems would, continued

- Provide the EPA's 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach
- Provide sampling results to the sampled facility, Primacy Agency, and state and local health departments
- Annually certify to the Primacy Agency that it met the notification and sampling requirements

Additional Information

Comparison of Incremental Costs and Benefits for the Proposed Revisions

	3% Discount Rate (2016$)	7% Discount Rate (2016$)
Annualized Incremental Costs	$131 - 270 Million	$130 – 286 Million
Annualized Incremental Benefits	$211 - 521 Million	$36 – 97 Million
Annual Net Benefits	**$79 - 251 Million**	**-$93 – 189 Million**


Questions?

Next Steps

- Submit your comments by February 12, 2020 via http://www.regulations.gov
  - Docket ID No. EPA-HQ-OW-2017-0300
- Review and evaluate public comments
- Promulgate Final LCR Revisions in 2020

Message

From: Kempic, Jeffrey [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=274AE714CBD24F8F896B76B20B669F36-JKEMPIC]
Sent: 1/28/2020 9:25:46 PM
To: Jonathan Davis [jdavis@csg.org]
Subject: RE: Invitation to present in a webinar on the LCR
Attachments: TechnicalBrief_LCR Proposed Revisions_12.18.19.OGWDW.pptx

Jon,

I have attached the big slide deck. I did this set of slides at AWWA WQTC in November in an hour time slot and covered the slides in under 40 minutes as I skipped a bunch of the introduction slides in that talk as well. I think this should work for Monday.

Jeff

From: Jonathan Davis <jdavis@csg.org>
Sent: Tuesday, January 28, 2020 2:09 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Subject: RE: Invitation to present in a webinar on the LCR

Jeff,

Probably somewhere between 17 and 45 slides. Since you're the sole presenter, you'll have 40 minutes available, so we're that provide a bit of overview before delving into the policy-related issues upon which our legislators are likely to focus – including action levels, the new trigger level, replacement of lead service lines, reporting requirements, funding, lead in schools and daycare facilities – without getting into the weeds in technical detail. If it would help to further talk by phone, I'm available all afternoon.

Jon

From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Tuesday, January 28, 2020 10:49 AM
To: Jonathan Davis <jdavis@csg.org>
Subject: RE: Invitation to present in a webinar on the LCR

[EXTERNAL EMAIL]

Jon,

I am trying to decide between the short overview presentation (about 17 slides) or the more detailed, which includes the overview (which I would mostly skip) and discusses in detail the proposed requirements (total of 45 slides, with 15 I would probably skip). Which slide deck do you think would be the appropriate one for Monday? Let me know when you get a chance. Thanks.

Jeff

From: Jonathan Davis <jdavis@csg.org>
Sent: Thursday, January 23, 2020 4:32 PM

To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Subject: RE: Invitation to present in a webinar on the LCR

Jeff,

Great news, and thanks. I'll look forward to the webinar.

Jon

From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Thursday, January 23, 2020 3:07 PM
To: Jonathan Davis <jdavis@csg.org>
Subject: RE: Invitation to present in a webinar on the LCR

[EXTERNAL EMAIL]

Jon,

Yes, I am available to proceed on Monday Feb 3. I will get you the picture and slides next week. Thanks.

Jeff

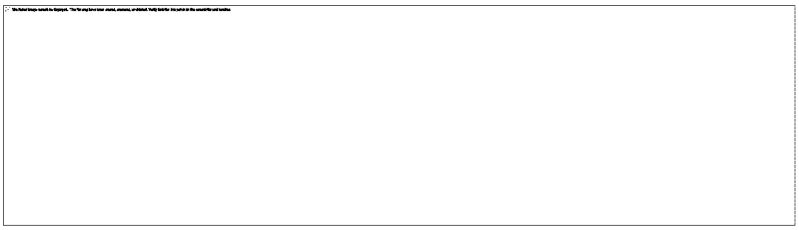
From: Jonathan Davis <jdavis@csg.org>
Sent: Tuesday, January 21, 2020 10:29 AM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Subject: FW: Invitation to present in a webinar on the LCR

Jeff,

Per my voice message, I'm following up on my email from Jan. 6 (below). Are you available to proceed on the morning of Monday, Feb. 3?

Thanks,

Jon Davis | Policy Analyst | Assistant Editor
The Council of State Governments, Midwestern Office
701 East 22nd Street, Suite 110 | Lombard, IL 60148
phone: 630.925.1922
www.csgmidwest.org



From: Jonathan Davis
Sent: Monday, January 6, 2020 4:23 PM

To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: RE: Invitation to present in a webinar on the LCR

Jeff,

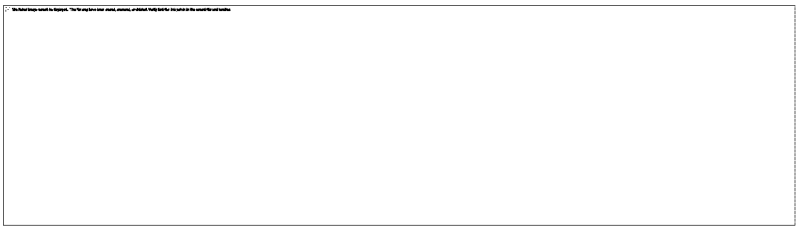
Thanks for the heads-up about the extension. Let's go ahead with Feb. 3 for the webinar; we can devote the entire call to the LCR. Our members will be more interested in the policy details rather than the technical ones, so we're anticipating that we won't need a great deal of time needed for Q&A, since they'll need some time to process what they're going to hear. Can that fit into 30 minutes or will you need/want more time?

Can you please send us an image – preferably 300 dpi or better -- and also a title? And, so we can share the slidedeck in advance, can you please get your slides to me by Thursday, Jan. 30?

Thank you again for your assistance.

Sincerely,

Jon Davis | Policy Analyst | Assistant Editor
The Council of State Governments, Midwestern Office
701 East 22nd Street, Suite 110 | Lombard, IL 60148
phone: 630.925.1922
www.csgmidwest.org



From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Monday, January 6, 2020 1:27 PM
To: Jonathan Davis <jdavis@csg.org>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: RE: Invitation to present in a webinar on the LCR

[EXTERNAL EMAIL]

Jon,

That should work – the comment period was extended until February 12, 2020 recently:

https://www.federalregister.gov/documents/2019/12/19/2019-27282/national-primary-drinking-water-regulations-lead-and-copper-rule-revisions

The February 3date would still be within the comment period for the rule. You may want to allow more time as it may be tight to go over the proposed rule requirements and have a Q&A in all of those key areas of the proposed rule.

Hope that helps.

Jeff

Jeffrey Kempic
Treatment Technology and Cost Team Leader
Standards and Risk Management Division
Phone: (202) 564-4880

From: Jonathan Davis <jdavis@csg.org>
Sent: Friday, January 03, 2020 3:11 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: RE: Invitation to present in a webinar on the LCR

Jeff,

Thank you for your reply. It's a bit too late for Monday the 6th, but we would like to schedule you for a webinar on the LCR, even if it's after the comment period closes.

The Caucus' Task Force on Lead has a conference call scheduled on Monday, Feb. 3 at 8:30 a.m. CST/9:30 a.m. EST – might you be available then? We envision about a 30 minute presentation plus Q&A, on topics including action levels, new trigger level, replacement of lead service lines, reporting requirements, funding, lead in schools and daycare facilities. Does this seem doable, or should we allow more time? And are there any elements of the new LCR that we're missing?

Thank you again for your assistance and willingness to present to the Caucus.

Sincerely,

Jon Davis | Policy Analyst | Assistant Editor
The Council of State Governments, Midwestern Office
701 East 22nd Street, Suite 110 | Lombard, IL 60148
phone: 630.925.1922
www.csgmidwest.org

From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Friday, January 3, 2020 9:56 AM
To: Jonathan Davis <jdavis@csg.org>

Cc: Lisa Janairo <ljanairo@csg.org>
Subject: RE: Invitation to present in a webinar on the LCR

[EXTERNAL EMAIL]

Jon,

I was on leave until yesterday and did not get approval to possibly do the webinar until this morning. I am available on Monday, but not next Friday. Do you still want to try to do the webinar given the short lead time? If so, let me know so we can discuss the details and what your members are interested in regarding the lead and copper rule. Thanks.

Jeff

Jeffrey Kempic
Treatment Technology and Cost Team Leader
Standards and Risk Management Division
Phone: (202) 564-4880

From: Jonathan Davis <jdavis@csg.org>
Sent: Monday, December 30, 2019 12:21 PM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Cc: Lisa Janairo <ljanairo@csg.org>
Subject: Invitation to present in a webinar on the LCR
Importance: High

Mr. Kempic,

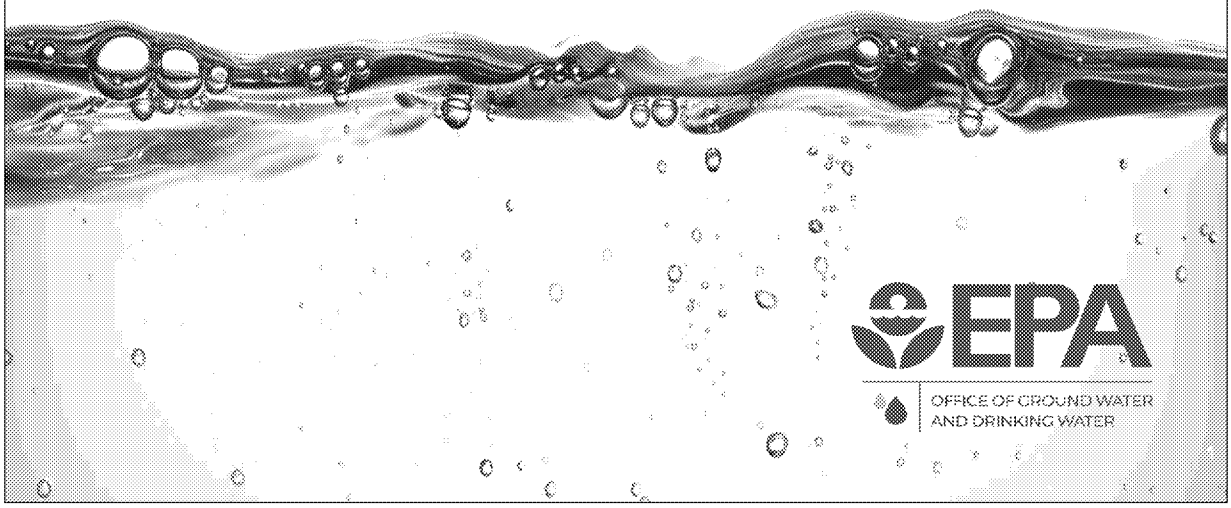
Per my phone message, the Great Lakes-St. Lawrence Legislative Caucus is hosting a webinar next week on revisions to the Lead and Copper Rule. Alan Walts recommended you to us as a potential presenter; would you be available either at 1 p.m. CST on Monday, Jan. 6, or 9 a.m. CST on Friday, Jan. 10?

Sincerely,

Jon Davis | Policy Analyst | Assistant Editor
The Council of State Governments, Midwestern Office
701 East 22nd Street, Suite 110 | Lombard, IL 60148
phone: 630.925.1922
www.csgmidwest.org

Proposed Lead and Copper Rule Revisions

Version: December 18, 2019



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Agenda

- Proposed Revisions Highlights
- Background
- Overview of the Proposed Rule
- Key Requirements and Proposed Revisions
- Additional Information
- Questions

Proposed Revisions: Highlights

- Takes a proactive and holistic approach to improving the current rule—from testing to treatment to telling the public about the levels and risks of lead in drinking water
- Requires earlier action to reduce risks and better protect families
- Includes efforts to improve transparency and communication to help protect children from lead exposure where they live, learn and play

Background

Overview: Current Lead and Copper Rule (LCR)

- Lead is not naturally found in water
- Lead from lead pipes, faucets, and fixtures can dissolve into water or sometimes can enter as flakes or small particles
- To keep lead from entering the water, EPA requires some systems to treat water using certain chemicals that keep the lead in place by reducing corrosion
- When corrosion control alone is not sufficient to control lead exposure, EPA requires systems to educate the public about risks of lead in drinking water and to replace lead service lines

Overview: Current LCR

- LCR was promulgated 1991, revised in 2000 and 2007
- Applies to 68,000 community (CWS) and non-transient non-community (NTNCWS) public water systems serving ~300 million people
- EPA is continuously working with primacy agencies to ensure that the LCR is being properly implemented

Overview: Current LCR

- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L (ppb)
  - Copper - 1.3 mg/L (ppm)

Proposed Revisions: Development

- EPA has conducted extensive consultations regarding potential LCR revisions including:
  - Science Advisory Board
  - National Drinking Water Advisory Council
  - State, Local and Tribal officials
- Based upon this input and experience implementing the LCR, EPA has developed revisions that target actions to reduce lead exposure where it is needed most
- The proposed rule will identify the most at-risk communities and ensure systems have plans in place to rapidly respond by taking actions to reduce elevated levels of lead in drinking water

Proposed Revisions: Summary

- The proposed LCR maintains the current MCLG of zero and AL of 15 ppb but requires a more comprehensive response at the action level and introduces a trigger level of 10 ppb
- The trigger level is a new flexible provision designed to compel water systems to take progressive, tailored actions to plan upgrades to aging infrastructure and reduce levels of lead in drinking water
- This approach focuses on six key areas

Proposed Revisions: Key Areas

1. Identifying areas most impacted
2. Strengthening treatment requirements
3. Replacing lead service lines
4. Increasing sampling reliability
5. Improving risk communication
6. Protecting children in schools

Proposed Revisions: Key Area 1

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Identifying Areas Most Impacted

- The EPA will for the first time require systems to develop a public lead service line inventory and create a plan for removing lead service lines
- Unlike now, systems will have to pay attention to individual locations with elevated levels of lead by identifying the cause and mitigating the problem (find & fix)

Proposed Revisions: Key Area 2

Strengthening treatment requirements

- Based on sampling results, systems with elevated lead levels will reevaluate their existing corrosion control treatment or conduct a treatment study so that they are prepared to respond quickly when necessary
- Flexibility is important for small systems so that they can protect public health by taking the action that makes sense for their community

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines

- Systems above the trigger level of 10 parts per billion would be required to work with their state to set an annual goal for replacing lead service lines
- Water systems above 15 parts per billion would be required to fully replace a minimum of three percent of the number of known or potential lead service lines annually

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines, continued

- Importantly, the proposal prohibits "test-outs" to avoid replacing lead service lines – an allowed practice under the current rule that has significantly slowed national progress in removing this significant source of lead from our homes
- Partial lead service line replacements will no longer be allowed except in certain situations (e.g., emergency repair) because science has recently shown us that partial lead service line replacement may increase short-term lead exposure

Proposed Revisions: Key Area 4

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Increasing Sampling Reliability

- Water systems will follow new, improved sampling procedures, will adjust sampling sites to better target locations with higher lead levels, and systems with higher levels will sample more frequently

Proposed Revisions: Key Area 5

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Improving Risk Communication

- Homeowners will learn about elevated levels of lead in their system sooner
- They will also understand where lead services lines are in their community and how to protect their family from exposure to lead

Proposed Revisions: Key Area 6

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Protecting Children in Schools

- For the first time, systems will be required to test school and child care facilities
- The system would be required to provide the results and information about the actions the school or child care facility can take to reduce lead in drinking water

Proposed Revisions Details

Current LCR: Action Level

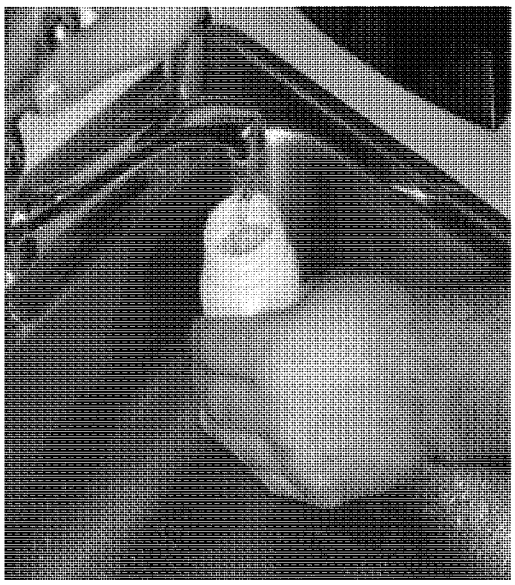
- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L
  - Copper - 1.3 mg/L

Proposed Revisions: Lead Trigger Level

- Propose a new Lead Trigger Level (TL) of 10 µg/L
- TL is in addition to the lead action level (AL) of 15 µg/L
- Water systems that exceed the TL but not the AL:
  - No reduced tap sampling, annual at standard number of sites
  - Implement goal based LSLR program
  - Annual outreach to LSL customers
  - CCT study if CCT not installed
  - Re-optimize if CCT is installed

Current LCR: Tap Sampling

- All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are subject to monitoring requirements
- Systems must collect first-draw samples at taps in homes/buildings that are at high risk of lead and copper contamination



Current LCR: Tap Sampling, continued

- The number of required samples varies by the size of the population served by the system, from 100 samples for large systems serving over 100K people down to 5 samples for systems serving 100 or fewer people
- Systems must conduct monitoring every 6 months unless they qualify for reduced monitoring
- The number of required samples and sampling frequency may be reduced if systems meet certain requirements
- Systems were required to perform a materials evaluation to identify a pool of targeted sampling sites

Proposed Revisions: Tap Sampling

- Lead Service Line Inventory: Require all water systems to create an inventory of lead service lines and update it annually
- Tap sample site selection criteria (tiering)
  - Revise the tap sample site tiering criteria to emphasize sampling from LSL sites
  - Recategorize all copper pipe with lead solder sites regardless of age
- 90th percentile calculation for lead
  - Water systems with LSLs would use 100% tap samples from LSL sites
  - Water systems with insufficient numbers of LSLs collect samples from LSL and non-LSL sites would use the highest non-LSL tap samples
  - Water systems without LSLs would use all tap samples collected

Proposed Revisions: Tap Sampling, continued

- Tap sample collection protocol
  - Prohibit systems from including sampling instructions to remove and clean aerators or to conduct pre-stagnation flushing prior to the start of the required stagnation period
  - Systems must supply samplers/consumers with wide-mouth bottles to collect a tap sample
- Monitoring
  - Systems above the Trigger Level must monitor at least annually (not eligible for reduced triennial monitoring)

Current LCR: Corrosion Control Treatment

- Systems serving > 50,000 people required to begin optimized corrosion control (OCCT) 1994-1998
- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL
  - Systems make optimal corrosion control recommendation to State
  - State approves or designates alternative
  - Follow-up monitoring conducted for one-year

Current LCR: Corrosion Control Treatment, continued

- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL, continued
  - State reviews data and designates optimal water quality parameters (OWQP)
  - Systems maintain OWQP
  - Systems compliance with the treatment technique is based on OWQP AL is exceeded
  - Small/medium systems can discontinue if they meet AL in two consecutive monitoring periods

Proposed Revisions: Corrosion Control Treatment

- Require water systems with OCCT to re-optimize if the 90th percentile lead level exceeds the TL or AL
- Require water systems without OCCT to study OCCT if the 90th percentile exceeds the TL and implement OCCT if the AL is exceeded
- Revise sanitary survey requirements for water systems to include CCT review and WQP assessment, including relevant updated guidance that has been issued by the EPA

Proposed Revisions: Corrosion Control Treatment, continued

- Specify that systems should evaluate an orthophosphate-based inhibitor as CCT (instead of a phosphate-based inhibitor) as part of the CCT study
- Establish additional specifications for water systems to study alternative CCT
- Require systems to conduct "find-and-fix" for individual sites that exceed the AL (See next slide)

Proposed Revisions: Find-and-Fix

- Require all systems to collect a follow-up sample for each lead tap sample site that exceeds 15 µg/L and require systems to subsequently implement a "find-and-fix" approach
- Systems must collect follow-up tap samples within 30 days of learning the results
- Systems would be required to report the results to the state, but the results would not be included in lead 90th percentile calculations

Proposed Revisions: Find-and-Fix, continued

- Systems with CCT would be required to collect an additional WQP sample at or near the site where the high lead sample was collected within 5 days of learning of the lead results
- Systems must determine if a CCT "fix" is needed (e.g., localized CCT change and/or a systemwide CCT change, spot flushing, distribution system operation improvements, system looping and other strategies to reduce dead ends)
- Systems that identify a fix that is out of their control, such as a customer that does not want an old brass faucet replaced, must provide documentation to their state

Current LCR: Notifications & Public Education

- The annual Consumer Confidence Report (CCR) sent to all consumers must include lead sampling results and an informational statement about the health effects of lead and actions to reduce exposure
- Public Notification sent to all consumers if water system has a violation of the treatment technique within 30 days; and notice of violation for failure to monitor or report results within one year

Current LCR: Notifications & Public Education, continued

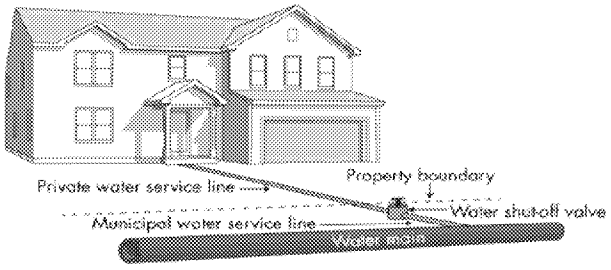
- Systems that exceed the lead action level must begin public education within 60 days after the end of monitoring period:
  - Educational materials must include information on health effects of lead, sources of lead, and steps consumers can take to reduce exposure to lead in drinking water
- Water systems send lead consumer notice with tap sample result to homes where a tap sample is collected within 30 days
- Note that the 2016 Water Infrastructure Improvement for the Nation Act (WIIN) requires notice of a 90th percentile lead level exceeding the AL within 24 hours

Proposed Revisions: Notification and Public Education

- Revise CCR mandatory health effects language and require reporting of the range of tap sample levels in addition to the 90th% and number of samples greater then the lead AL
- Water systems must conduct public notification to consumers within 24 hours of a 90th percentile lead level > AL (WIIN Act)
- Provide notice to customers whose individual tap sample is > 15 µg/L within 24 hours
- Require water systems with LSLs that exceed the TL to conduct annual outreach to LSL customers
- Deliver Public Education (PE) to impacted consumers during water-related work that may disturb LSLs
- Provide public access to LSL inventory

Current LCR: Lead Service Line Replacement

- Systems that exceed the lead Action Level (AL) after installing corrosion control treatment (CCT) must replace 7% of lead service lines per year
- Systems are only required to replace the portion of the LSL owned by the PWS
- Systems may consider an LSL replaced if a sample from that line is below the AL
- Systems must offer to replace customer owned portion at customer cost
- LSLR can stop when lead ≤ AL for 2 consecutive monitoring periods



Proposed Revisions: Lead Service Line Replacement (LSLR)

- Water systems with LSLs would prepare an LSLR program plan and establish an LSLR goal rate with state approval
- Water systems must replace public portion of LSL when customer notifies them of replacement of private portion
- Water systems that exceed the lead TL, but not the AL, would implement the goal based LSLR program
  - Water systems can stop goal based LSLR when system is below the TL for 2 consecutive monitoring periods

Proposed Revisions: Lead Service Line Replacement (LSLR), continued

- Water systems that exceed the lead AL would replace annually 3% of LSLs
  - Water systems can stop 3% annual LSLR when system is below the AL for 4 consecutive monitoring periods
- All LSLR will be full replacements
  - Partial LSLR only for emergency repair or "unwilling or unable customers" when conducting infrastructure replacement (e.g., main replacement)
- Removes the "test out" provision
- Require pitcher filters to be distributed and replacement cartridges by the PWS for three months immediately following lead service replacement

Proposed Revisions: Lead Service Line Replacement (LSLR)

Proposed LCRR:
Requires 3% annual LSLR when lead action level is exceeded

- The entire LSL must be replaced to count towards 3% annual LSLR
- LSLR can stop after **4** monitoring rounds ≤ AL

Trigger Level:

- The entire LSL must be replaced to count towards goal LSLR rate approved by the state

Current LCR:
Requires 7% annual LSLR when lead action level is exceeded

- Allows system to replace only the water system portion of the LSL
- Allows systems to test LSLs and count as replaced if samples are ≤ 15 ppb
- Both of the above allow systems to meet 7% annual LSLR while leaving portions or entire LSLs in place
- LSLR can stop after **2** monitoring rounds ≤ AL

There is no trigger level requiring LSLR

Proposed Revisions: Small System Flexibility

- Applies to CWSs serving 10,000 or fewer persons and all NTNCWS
- Compliance alternatives for small CWSs:
  - full lead service line replacement
  - installation and maintenance of optimized corrosion control treatment, and
  - installation and maintenance of point-of-use (POU) devices

Proposed Revisions: Small System Flexibility, continued

- Compliance alternatives for NTNCWSs:
  - same alternatives as above, and
  - replacement of all lead bearing plumbing fixtures at every tap where water could be used for human consumption
- Water systems with a lead TL would recommend a compliance option and obtain Primacy Agency approval
- If a water system subsequently exceeds the lead AL it must implement the approved option

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

Community Water Systems would

- Develop a list of customers or service connections that provide water to schools or licensed child care providers and verify this list every five years
- Each year, a CWS would collect samples at 20 percent of schools and 20 percent of child care facilities from the list. Therefore, a CWS would collect samples at each facility once every five years
- For each child care facility: collect two samples
- For each school: collect five samples

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

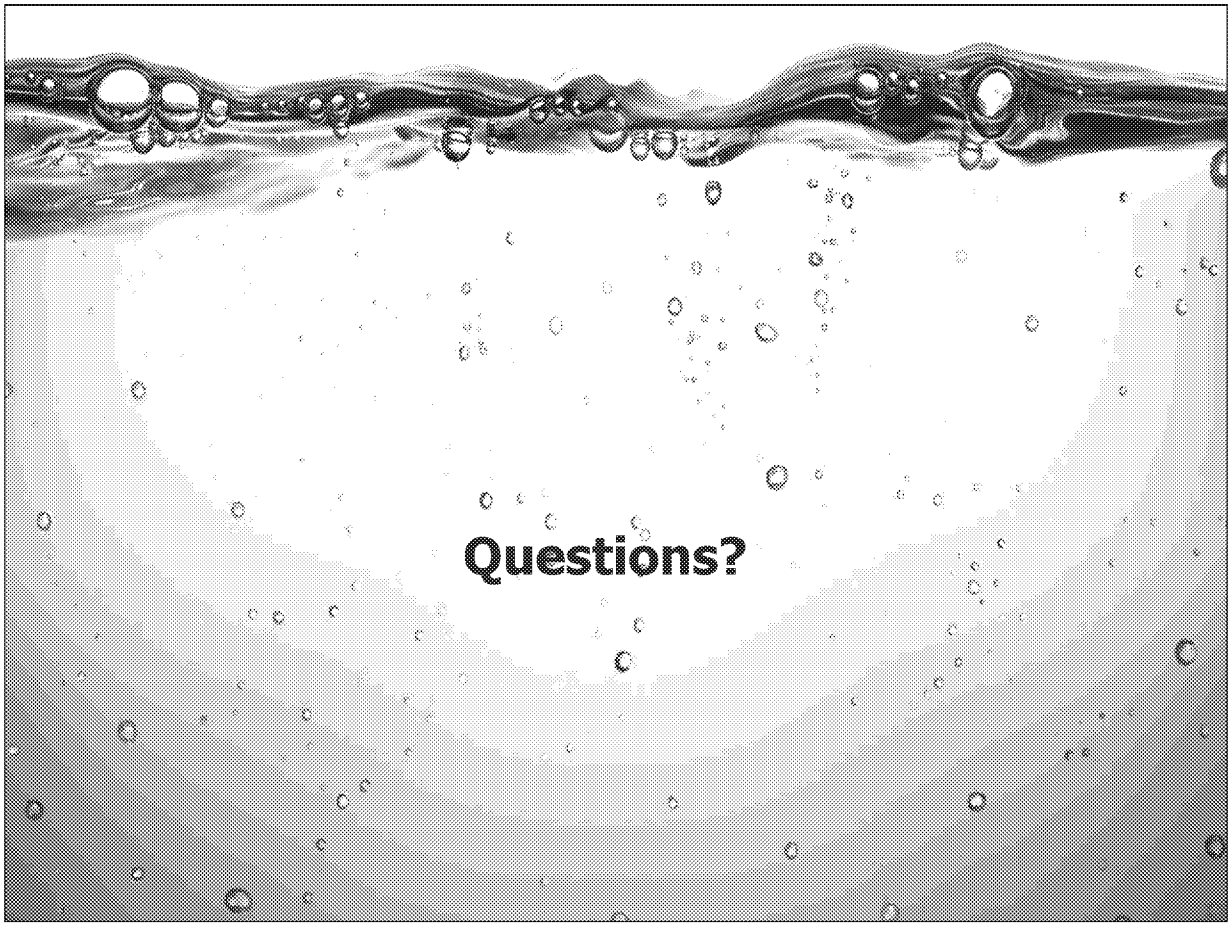
Community Water Systems would, continued

- Provide the EPA's 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach
- Provide sampling results to the sampled facility, Primacy Agency, and state and local health departments
- Annually certify to the Primacy Agency that it met the notification and sampling requirements

Additional Information

Comparison of Incremental Costs and Benefits for the Proposed Revisions

	3% Discount Rate (2016$)	7% Discount Rate (2016$)
Annualized Incremental Costs	$131 - 270 Million	$130 – 286 Million
Annualized Incremental Benefits	$211 - 521 Million	$36 – 97 Million
Annual Net Benefits	**$79 - 251 Million**	**-$93 – 189 Million**


Questions?

Next Steps

- Submit your comments by February 12, 2020 via http://www.regulations.gov
  - Docket ID No. EPA-HQ-OW-2017-0300
- Review and evaluate public comments
- Promulgate Final LCR Revisions in 2020

Message

From: Kempic, Jeffrey [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=274AE714CBD24F8F896B76B20B669F36-JKEMPIC]
Sent: 10/28/2019 8:05:30 PM
To: Sierra Dontanville [SDontanville@awwa.org]
Subject: RE: WQTC- Speaker Confirmation Response Requested
Attachments: LCR Proposed Revisions Draft Brief_10.25.19.OGWDW.pptx

Sierra,

I have attached a copy of the slides. Let me know if you need anything else. Thanks.

Jeff

From: Sierra Dontanville <SDontanville@awwa.org>
Sent: Friday, October 25, 2019 3:04 AM
To: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Subject: RE: WQTC- Speaker Confirmation Response Requested

Jeff,

Would it be possible for you to upload a draft of the slides by the end of the day Friday, October 25th?

Thank you,
Sierra

Sierra Dontanville, EIT
Associate Engineer
American Water Works Association
303.347.6252

From: Kempic, Jeffrey <Kempic.Jeffrey@epa.gov>
Sent: Tuesday, October 22, 2019 11:28 AM
To: Sierra Dontanville <SDontanville@awwa.org>
Subject: RE: WQTC- Speaker Confirmation Response Requested

Sierra,

The Lead and Cooper Rule Revisions proposal was signed on October 10, 2019. We are working on finalizing slides about the proposed rule, but they won't be approved until the end of this week. I hope to be able to upload them next week after they are approved. Let me know if you need anything else. Thanks.

Jeff

From: Sierra Dontanville <SDontanville@awwa.org>
Sent: Tuesday, October 22, 2019 12:03 PM

To: Sierra Dontanville <SDontanville@awwa.org>
Subject: WQTC- Speaker Confirmation Response Requested
Importance: High

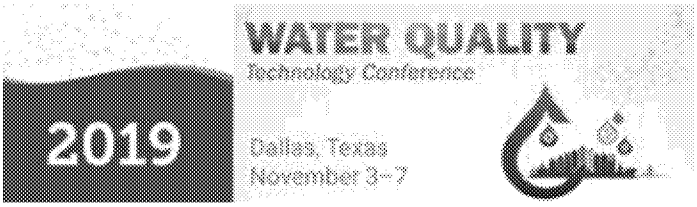
Hello,

I am reaching out since we have not received a presentation from you for the Water Quality Technology Conference on November 3rd-7th. This conference has a **No Paper, No Podium** policy so without your presentation uploaded prior to the conference you run the risk of us replacing your presentation with an alternate speaker who has their presentation turned in. Please let me know as soon as possible that you plan to upload your presentation for the conference.

If you foresee any reason why you would not be available for the conference, please let me know as soon as possible.

Thank you,
Sierra Dontanville

Sierra Dontanville, EIT
Associate Engineer
American Water Works Association
303.347.6252



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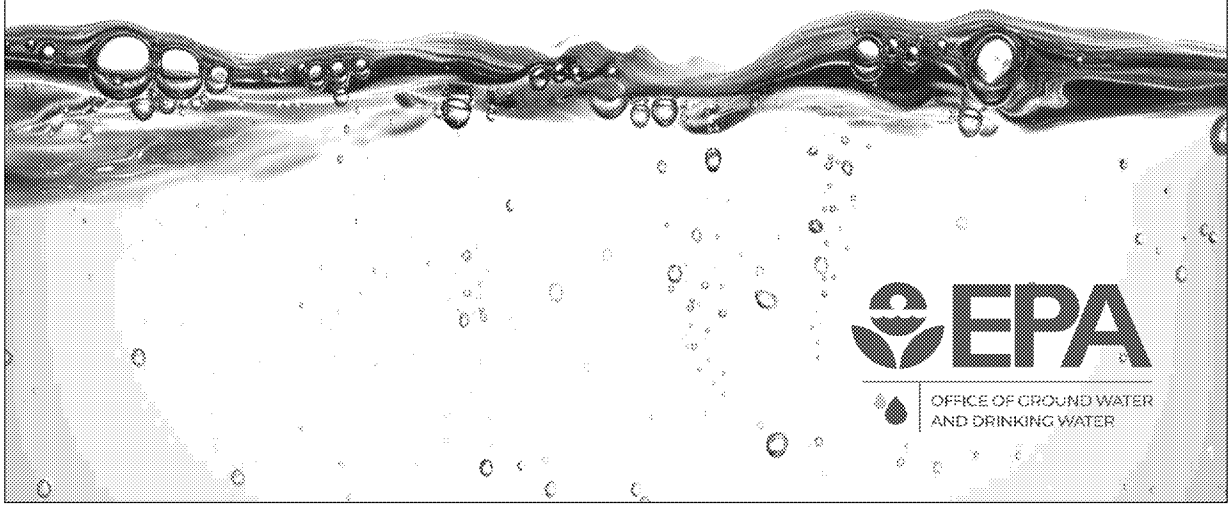
Proposed Lead and Copper Rule Revisions

Version: October 25, 2019



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Proposed Revisions: Key Area 1

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Proposed Revisions: Key Area 2

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Strengthening treatment requirements

- Based on sampling results, systems with elevated lead levels will reevaluate their existing corrosion control treatment or conduct a treatment study so that they are prepared to respond quickly when necessary
- Flexibility is important for small systems so that they can protect public health by taking the action that makes sense for their community

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines

- Systems above the trigger level of 10 parts per billion would be required to work with their state to set an annual goal for replacing lead service lines
- Water systems above 15 parts per billion would be required to fully replace a minimum of three percent of the number of known or potential lead service lines annually

Proposed Revisions: Key Area 3

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Replacing Lead Service Lines, continued

- Importantly, the proposal prohibits "test-outs" to avoid replacing lead service lines – an allowed practice under the current rule that has significantly slowed national progress in removing this significant source of lead from our homes
- Partial lead service line replacements will no longer be allowed except in certain situations (e.g., emergency repair) because science has recently shown us that partial lead service line replacement may increase short-term lead exposure

Proposed Revisions: Key Area 4

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Increasing Sampling Reliability

- Water systems will follow new, improved sampling procedures, will adjust sampling sites to better target locations with higher lead levels, and systems with higher levels will sample more frequently

Proposed Revisions: Key Area 5

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Improving Risk Communication

- Homeowners will learn about elevated levels of lead in their system sooner
- They will also understand where lead services lines are in their community and how to protect their family from exposure to lead

Proposed Revisions: Key Area 6

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Protecting Children in Schools

- For the first time, systems will be required to test school and child care facilities
- The system would be required to provide the results and information about the actions the school or child care facility can take to reduce lead in drinking water

Proposed Revisions Details

Current LCR: Action Level

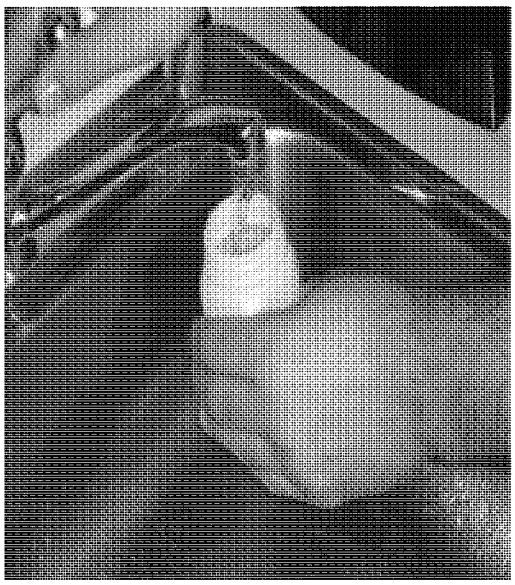
- Maximum Contaminant Level Goals (MCLG)
  - Lead – 0 µg/L
  - Copper – 1.3 mg/L
- 90th percentile tap sampling results are compared to an action level (AL)
  - Lead - 15 µg/L
  - Copper - 1.3 mg/L

Proposed Revisions: Lead Trigger Level

- Propose a new Lead Trigger Level (TL) of 10 µg/L
- TL is in addition to the lead action level (AL) of 15 µg/L
- Water systems that exceed the TL but not the AL:
  - No reduced tap sampling, annual at standard number of sites
  - Implement goal based LSLR program
  - Annual outreach to LSL customers
  - CCT study if CCT not installed
  - Re-optimize if CCT is installed

Current LCR: Tap Sampling

- All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are subject to monitoring requirements
- Systems must collect first-draw samples at taps in homes/buildings that are at high risk of lead and copper contamination



Current LCR: Tap Sampling, continued

- The number of required samples varies by the size of the population served by the system, from 100 samples for large systems serving over 100K people down to 5 samples for systems serving 100 or fewer people
- Systems must conduct monitoring every 6 months unless they qualify for reduced monitoring
- The number of required samples and sampling frequency may be reduced if systems meet certain requirements
- Systems were required to perform a materials evaluation to identify a pool of targeted sampling sites

Proposed Revisions: Tap Sampling

- Lead Service Line Inventory: Require all water systems to create an inventory of lead service lines and update it annually
- Tap sample site selection criteria (tiering)
  - Revise the tap sample site tiering criteria to emphasize sampling from LSL sites
  - Recategorize all copper pipe with lead solder sites regardless of age
- 90th percentile calculation for lead
  - Water systems with LSLs would use 100% tap samples from LSL sites
  - Water systems with insufficient numbers of LSLs collect samples from LSL and non-LSL sites would use the highest non-LSL tap samples
  - Water systems without LSLs would use all tap samples collected

Proposed Revisions: Tap Sampling, continued

- Tap sample collection protocol
  - Prohibit systems from including sampling instructions to remove and clean aerators or to conduct pre-stagnation flushing prior to the start of the required stagnation period
  - Systems must supply samplers/consumers with wide-mouth bottles to collect a tap sample
- Monitoring
  - Systems above the Trigger Level must monitor at least annually (not eligible for reduced triennial monitoring)

Current LCR: Corrosion Control Treatment

- Systems serving > 50,000 people required to begin optimized corrosion control (OCCT) 1994-1998
- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL
  - Systems make optimal corrosion control recommendation to State
  - State approves or designates alternative
  - Follow-up monitoring conducted for one-year

Current LCR: Corrosion Control Treatment, continued

- Systems serving ≤ 50,000 people must begin OCCT process when the system exceeds an AL, continued
  - State reviews data and designates optimal water quality parameters (OWQP)
  - Systems maintain OWQP
  - Systems compliance with the treatment technique is based on OWQP AL is exceeded
  - Small/medium systems can discontinue if they meet AL in two consecutive monitoring periods

Proposed Revisions: Corrosion Control Treatment

- Require water systems with OCCT to re-optimize if the 90th percentile lead level exceeds the TL or AL
- Require water systems without OCCT to study OCCT if the 90th percentile exceeds the TL and implement OCCT if the AL is exceeded
- Revise sanitary survey requirements for water systems to include CCT review and WQP assessment, including relevant updated guidance that has been issued by the EPA

Proposed Revisions: Corrosion Control Treatment, continued

- Specify that systems should evaluate an orthophosphate-based inhibitor as CCT (instead of a phosphate-based inhibitor) as part of the CCT study
- Establish additional specifications for water systems to study alternative CCT
- Require systems to conduct "find-and-fix" for individual sites that exceed the AL (See next slide)

Proposed Revisions: Find-and-Fix

- Require all systems to collect a follow-up sample for each lead tap sample site that exceeds 15 µg/L and require systems to subsequently implement a "find-and-fix" approach
- Systems must collect follow-up tap samples within 30 days of learning the results
- Systems would be required to report the results to the state, but the results would not be included in lead 90th percentile calculations

Proposed Revisions: Find-and-Fix, continued

- Systems with CCT would be required to collect an additional WQP sample at or near the site where the high lead sample was collected within 5 days of learning of the lead results
- Systems must determine if a CCT "fix" is needed (e.g., localized CCT change and/or a systemwide CCT change, spot flushing, distribution system operation improvements, system looping and other strategies to reduce dead ends)
- Systems that identify a fix that is out of their control, such as a customer that does not want an old brass faucet replaced, must provide documentation to their state

Current LCR: Notifications & Public Education

- The annual Consumer Confidence Report (CCR) sent to all consumers must include lead sampling results and an informational statement about the health effects of lead and actions to reduce exposure
- Public Notification sent to all consumers if water system has a violation of the treatment technique within 30 days; and notice of violation for failure to monitor or report results within one year

Current LCR: Notifications & Public Education, continued

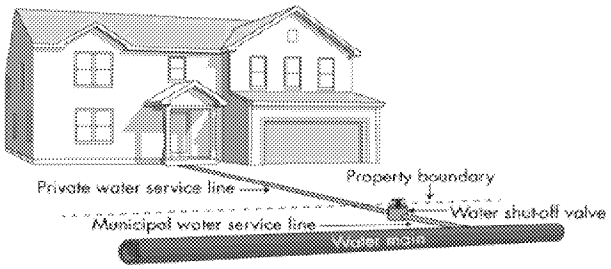
- Systems that exceed the lead action level must begin public education within 60 days after the end of monitoring period:
  - Educational materials must include information on health effects of lead, sources of lead, and steps consumers can take to reduce exposure to lead in drinking water
- Water systems send lead consumer notice with tap sample result to homes where a tap sample is collected within 30 days
- Note that the 2016 Water Infrastructure Improvement for the Nation Act (WIIN) requires notice of a 90th percentile lead level exceeding the AL within 24 hours

Proposed Revisions: Notification and Public Education

- Revise CCR mandatory health effects language and require reporting of the range of tap sample levels in addition to the 90th% and number of samples greater then the lead AL
- Water systems must conduct public notification to consumers within 24 hours of a 90th percentile lead level > AL (WIIN Act)
- Provide notice to customers whose individual tap sample is > 15 µg/L within 24 hours
- Require water systems with LSLs that exceed the TL to conduct annual outreach to LSL customers
- Deliver Public Education (PE) to impacted consumers during water-related work that may disturb LSLs
- Provide public access to LSL inventory

Current LCR: Lead Service Line Replacement

- Systems that exceed the lead Action Level (AL) after installing corrosion control treatment (CCT) must replace 7% of lead service lines per year
- Systems are only required to replace the portion of the LSL owned by the PWS
- Systems may consider an LSL replaced if a sample from that line is below the AL
- Systems must offer to replace customer owned portion at customer cost
- LSLR can stop when lead ≤ AL for 2 consecutive monitoring periods



Proposed Revisions: Lead Service Line Replacement (LSLR)

- Water systems with LSLs would prepare an LSLR program plan and establish an LSLR goal rate with state approval
- Water systems must replace public portion of LSL when customer notifies them of replacement of private portion
- Water systems that exceed the lead TL, but not the AL, would implement the goal based LSLR program
  - Water systems can stop goal based LSLR when system is below the TL for 2 consecutive monitoring periods

Proposed Revisions: Lead Service Line Replacement (LSLR), continued

- Water systems that exceed the lead AL would replace annually 3% of LSLs
  - Water systems can stop 3% annual LSLR when system is below the AL for 4 consecutive monitoring periods
- All LSLR will be full replacements
  - Partial LSLR only for emergency repair or "unwilling or unable customers" when conducting infrastructure replacement (e.g., main replacement)
- Removes the "test out" provision
- Require pitcher filters to be distributed and replacement cartridges by the PWS for three months immediately following lead service replacement

Proposed Revisions: Lead Service Line Replacement (LSLR)

Proposed LCRR:
Requires 3% annual LSLR when lead action level is exceeded

- The entire LSL must be replaced to count towards 3% annual LSLR
- LSLR can stop after **4** monitoring rounds ≤ AL

Trigger Level:

- The entire LSL must be replaced to count towards goal LSLR rate approved by the state

Current LCR:
Requires 7% annual LSLR when lead action level is exceeded

- Allows system to replace only the water system portion of the LSL
- Allows systems to test LSLs and count as replaced if samples are ≤ 15 ppb
- Both of the above allow systems to meet 7% annual LSLR while leaving portions or entire LSLs in place
- LSLR can stop after **2** monitoring rounds ≤ AL

There is no trigger level requiring LSLR

Proposed Revisions: Small System Flexibility

- Applies to CWSs serving 10,000 or fewer persons and all NTNCWS
- Compliance alternatives for small CWSs:
  - full lead service line replacement
  - installation and maintenance of optimized corrosion control treatment, and
  - installation and maintenance of point-of-use (POU) devices

Proposed Revisions: Small System Flexibility, continued

- Compliance alternatives for NTNCWSs:
  - same alternatives as above, and
  - replacement of all lead bearing plumbing fixtures at every tap where water could be used for human consumption
- Water systems with a lead TL would recommend a compliance option and obtain Primacy Agency approval
- If a water system subsequently exceeds the lead AL it must implement the approved option

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

Community Water Systems would

- Develop a list of customers or service connections that provide water to schools or licensed child care providers and verify this list every five years
- Each year, a CWS would collect samples at 20 percent of schools and 20 percent of child care facilities from the list. Therefore, a CWS would collect samples at each facility once every five years
- For each child care facility: collect two samples
- For each school: collect five samples

Proposed Revisions: Sampling and Education at Schools & Child Care Facilities

Community Water Systems would, continued

- Provide the EPA's 3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities: A Training, Testing, and Taking Action Approach
- Provide sampling results to the sampled facility, Primacy Agency, and state and local health departments
- Annually certify to the Primacy Agency that it met the notification and sampling requirements

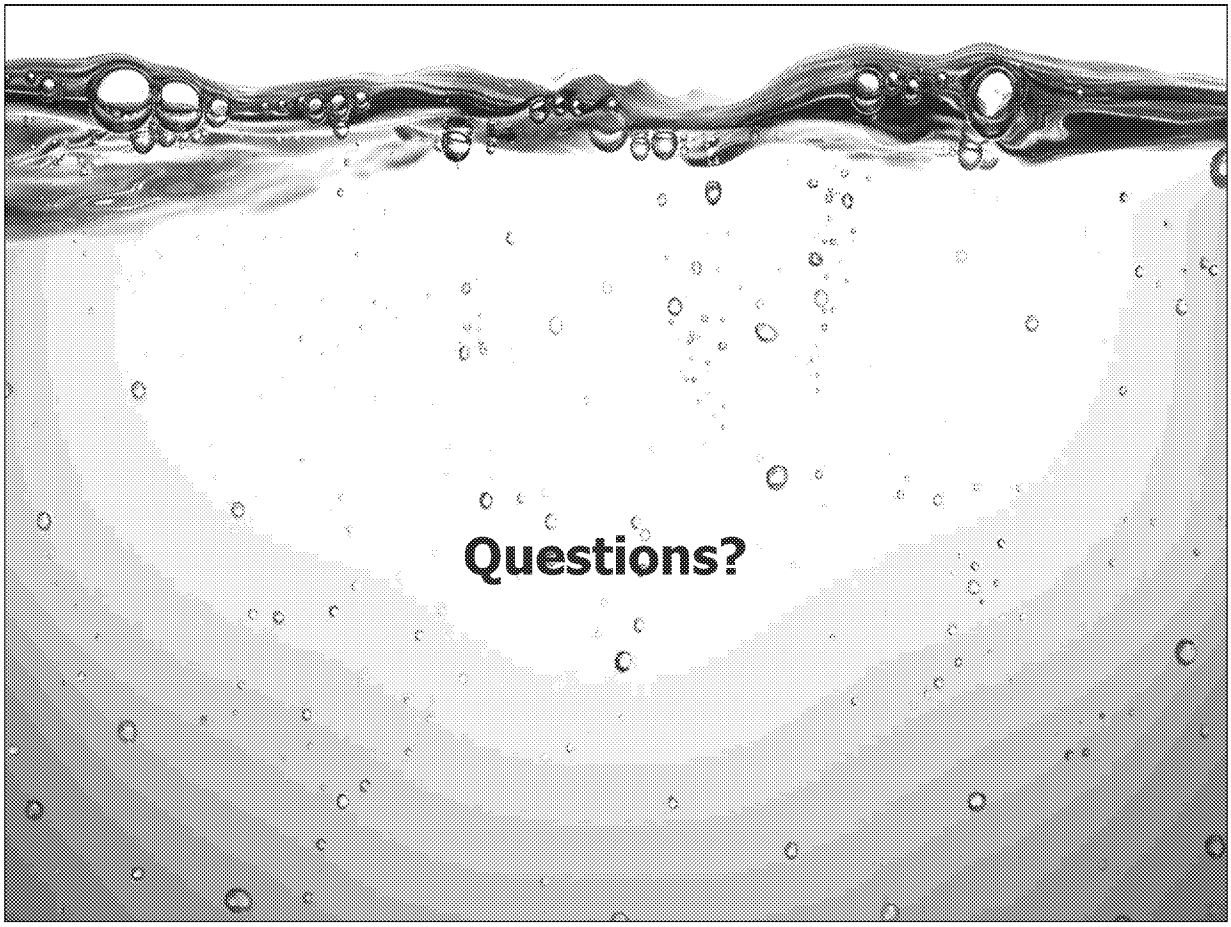
Additional Information

Comparison of Incremental Costs and Benefits for the Proposed Revisions

	3% Discount Rate (2016$)	7% Discount Rate (2016$)
Annualized Incremental Costs	$131 - 270 Million	$130 – 286 Million
Annualized Incremental Benefits	$211 - 521 Million	$36 – 97 Million
Annual Net Benefits	**$79 - 251 Million**	**-$93 – 189 Million**

Next Steps

- Pre-publication version and other materials available at: https://www.epa.gov/safewater/lcrproposal
- Publication in the Federal Register
- 60 day comment period following **publication**
  - Submit your comments at http://www.regulations.gov
  - Docket ID No. EPA-HQ-OW-2017-0300
- Review and evaluate public comments
- Promulgate Final LCR Revisions in 2020


Questions?