DOD SAFE DRINKING WATER ACT SERVICES STEERING COMMITTEE INFORMATION PAPER

CLARIFICATION OF LEAD AND COPPER RULE SAMPLING PRACTICES

PURPOSE. To explain proper sampling practices in the preparation and collection of Lead and Copper Rule (LCR) regulatory compliance drinking water samples.

REFERENCES. See Appendix A for a list of references.

AUDIENCE.

This Information Paper (IP) is intended for any Installation personnel who have water system compliance, operation, medical oversight, or sampling responsibilities regardless of whether personnel are military, civilian, contract, or privatized. This includes Installation drinking water program managers, water system personnel (civilian, contracted, and privatized), preventive medicine personnel, and contracted sampling personnel.

BACKGROUND

Lead's Health Effects

Lead exposure poses a potentially significant health concern. Lead's toxicity has been studied extensively and is known to cause adverse health effects even at low exposure levels. That is why, when the U.S. Environmental Protection Agency (EPA) promulgated the LCR in 1991, they established a Maximum Contaminant Level Goal (MCLG) of zero micrograms per liter (µg/L) for lead in drinking water. The MCLG is a non-enforceable standard at which no known or anticipated adverse health effects would occur. The population most susceptible to the adverse health effects from lead exposure are infants and children six years of age and younger. Levels of lead in drinking water can cause adverse health effects if the lead in the water enters the bloodstream. Ingestion of lead may cause an elevated blood lead level, which in turn may place infants and children at a higher risk of experiencing delays in their physical or mental development. Children may show deficits in attention span and learning abilities. Adults who drink this water over many years may develop kidney problems or high blood pressure.

How Lead gets into our Drinking Water

The current body of scientific knowledge and, more recently, the events in Flint, Michigan (MI) have shown us that lead in drinking water has the potential to be a major source of environmental exposure when sources of lead exist in our distribution systems and building plumbing. Lead is typically not present in water sources. Rather, lead in drinking water usually comes from the corrosion of lead-containing materials such as lead pipes, lead solder, and plumbing fixtures and fittings made from metal alloys like brass that contain some lead. Many DOD drinking water systems and plumbing systems in DOD facilities, just like in many cities and towns, are old and likely contain sources of lead. When these sources of lead experience corrosion they release lead into the drinking water. Lead release into drinking water can be caused by many different factors such as physical disturbances from main repairs, low water usage (i.e. stagnation), and water quality conditions (pH, alkalinity, temperature). When lead is released into the water, it can be in a solid form (particulate) or dissolved (soluble) form.

Purpose of the LCR

The EPA designed the LCR to mitigate lead (and copper) exposure from drinking water through effective corrosion control. Proper LCR regulatory compliance sampling accurately characterizes levels of lead in drinking water under normal water system operations and resident usage patterns with the purpose of effectively assessing how well corrosion control treatment is working to minimize lead release. The LCR also seeks to mitigate lead exposure through public education and awareness by routinely providing information about lead in drinking water and educating consumers about health risks and actions to reduce exposure to lead in drinking water.

The Need to Clarify LCR Sampling Procedures

The LCR defines a proper regulatory lead and copper sample as being:

> *"…one liter in volume and have stood motionless in the plumbing system of each sampling site for at least six hours. First-draw samples from residential housing shall be collected from the cold water kitchen tap or bathroom sink tap. First-draw samples from a non-residential building shall be one liter in volume and shall be collected at an interior tap from which water is typically drawn for consumption." [40CFR141.86(b)(2)]*

Note that the definition does not define an upper limit on how long water stands motionless. Due to this relatively generic definition of a proper LCR sample, detailed procedures on how to collect a proper LCR sample are susceptible to variations and modifications. Since the LCR's implementation in 1992, many States and water systems have subsequently adopted some practices that do not meet the intent of the LCR and result in improper samples collected. These practices could result in non-

representative samples being collected that may significantly underestimate lead levels, inaccurately characterize the effectiveness of corrosion control treatment, and ultimately allow a potentially significant health risk to go undetected. The EPA and, more recently, some national news organizations identified and highlighted these practices and their potential consequences. The practices that result in non-representative sample collection are:

- Removal of faucet aerators prior to collecting a sample;
- Practice of pre-stagnation flushing; and
- Use of sample containers with small openings affecting sample flow.

Samples should be representative of water that a resident would typically drink. A sample cannot be invalidated due to excessive stagnation periods or alleged homeowner error in sample collection.

PROPER LCR SAMPLING PRACTICES

Overview

This IP explains why these non-representative practices should not be included in LCR sampling procedures and sampling directions. This IP provides recommendations that DoD Installation drinking water program managers and water system personnel can take to avoid the practices and ensure proper and representative LCR samples are collected. DoD Installation drinking water program managers and water system personnel should review their LCR sampling procedures and directions regardless of whether samples are collected by residents, contractors, preventive medicine, or Installation water system personnel to ensure:

- Faucet aerators ***are not removed***;
- Pre-stagnation flushing ***is not conducted***; and
- Wide-mouth sample containers ***are used*** to collect samples at ***representative flows***.

Do Not Remove Faucet Aerators

Faucet aerators, the screens at the end of a faucet where water comes out, must not be removed prior to collecting an LCR sample. Faucet aerators can trap lead-containing particulates from upstream sources and could contribute lead in both solid (particulate, colloidal) and dissolved (soluble) forms to the drinking water. Removal of aerators prior to sampling could miss a source of lead in the drinking water and result in collection of a non-representative sample.

In a 2006 memorandum on the management of aerators during collection of LCR samples, EPA stated:

> *"Removal and cleaning of the aerator is advisable on a regular basis. However, if customers are only encouraged to remove and clean aerators prior to drawing a sample to test for lead, the public water 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. Therefore, public water systems should not recommend that customers remove or clean aerators prior to or during the collection of tap samples for lead."*

LCR sampling procedures and directions should contain language explicitly prohibiting the removal of faucet aerators. For example, simply stating, "Do not remove the faucet aerator prior to collecting the sample" is effective. Appendix B provides recommended sampling directions based on EPA's suggested directions.

Note: If a sample result (with aerator) is above the action level, the water system may want to take a second sample (without aerator or a clean aerator) to help determine whether particulate matter is the source of lead. Both sample results must be included in the 90th percentile calculation (i.e., the first sample could not be invalidated based on the presence of lead-bearing matter in the aerator).

Do Not Conduct Pre-stagnation Flushing

The LCR regulatory compliance samples must be collected from State-approved, occupied residences or non-residential buildings because this allows for an accurate assessment of corrosion control efficacy (when samples are properly collected). When collecting samples from these occupied facilities, flushing prior to letting the water sit motionless for at least six hours must be avoided. Conducting pre-stagnation flushing can alter the normal water usage patterns of residents and may result in missing potentially higher lead levels. LCR sampling directions that include language such as "Run the cold water from the kitchen faucet for 2-5 minutes before letting it sit for at least 6 hours," could flush out particulate lead and in most cases would completely flush out any water that has been sitting in contact with residence plumbing and the entire service line. This is not representative of normal water usage and could potentially miss higher levels of lead to which residents would be exposed.

The EPA in a 2008 letter related to the lead in drinking water issues experienced in Washington, DC clarified that pre-stagnation flushing should not be part of LCR sampling procedures:

> *"The purpose of the monitoring protocol is to determine if corrosion control is effective in reducing lead and copper leaching at times and locations where we would expect levels to be greatest under normal conditions. Therefore, we believe that homeowners collecting samples should use their water as they would normally, with the exception that the*

> *regulations require the water to stagnate for a minimum of six hours prior to collection of the sample…We do not understand why DC WASA believes it should be necessary to request flushing only in households participating in the sampling. While this may fall within a strict legal interpretation of the regulations, we believe that it goes against the intent of the monitoring protocol, since it changes the normal water use of the homeowners in the sample."*

LCR sampling procedures and directions should not contain language requiring pre-stagnation flushing.

Collect Samples at a Representative Flow Using Wide-Mouth Sample Bottles

LCR sampling procedures and directions must avoid any requirements to collect samples at a low flow. In addition, it is important to capture all the water when collecting a first draw sample. That is why sample bottles must have wide mouth openings (large openings) so as not to inadvertently limit the flow to avoid loss of water down the drain during sample collection.

Collecting LCR samples at a low flow rate (such as turning on the cold water tap until a small pencil-sized flow of water is achieved) can miss lead in the solid form (e.g. lead particles) that would normally get into a resident's glass of water or pot for cooking. A low flow can reduce or prevent the entrainment or mobilization of lead particles in the water that would normally be mobilized when a resident turns on their tap at a higher flow. Generally, people will turn on a faucet to a high flow such as turning the faucet almost fully open such as a ¾ open tap or at the highest flow achievable - fully opening the faucet. Samples should be collected at a flow that is representative of how water is typically drawn from the kitchen faucet when filling a glass of water or a pot for cooking.

LCR sample directions *should not* include language such as:

- "Slowly fill the sample bottle…"
- "Collect a sample by opening the cold water tap gently to achieve a low flow…"

LCR sample directions *should* contain language such as:

- "Fill the sample bottle just as you would when filling a glass of water…"
- "Open the cold water tap just as you would when filling a glass of water or a pot for cooking…"

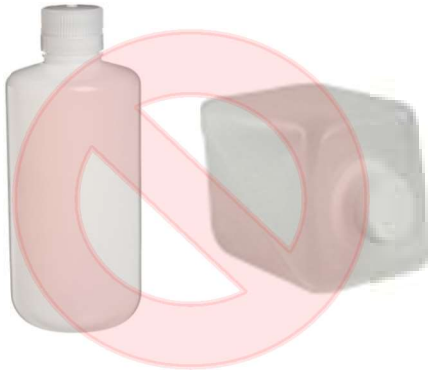
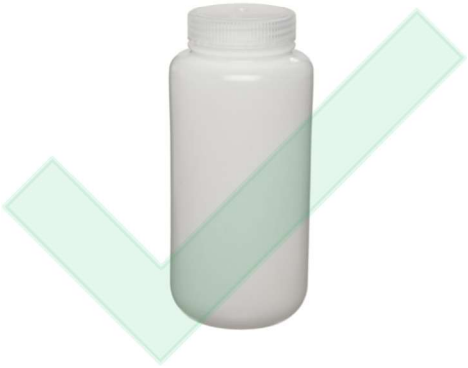
Using sample containers with narrow openings like those shown in Table 1 may inadvertently result in collecting samples at a low flow. Sample containers with narrow openings are more difficult to fill and would result in the sampler using a lower flow to avoid loss of water down the drain during sample collection. In EPA's 2016

memorandum clarifying LCR sampling procedures, EPA recommended using sample containers with wide-mouth openings:

> *"EPA recommends that wide-mouth bottles be used to collect Lead and Copper compliance samples. It has become apparent that wide-mouth bottles offer advantages over narrow-necked bottles because wide-mouth bottles allow for a higher flow rate during sample collection which is more representative of the flow that a consumer may use to fill up a glass of water. In addition, a higher flow rate can result in greater release of particulate and colloidal lead and therefore is more conservative in terms of identifying lead concentrations."*

Avoid sample containers with narrow openings in favor of wide-mouth sample containers (Table 1).

Table 1. Examples of Sample Containers.

Avoid Sample Containers with Narrow Openings	Use Wide-Mouth Sample Containers
	

CONCLUSIONS AND RECOMMENDATIONS.

Since the LCR's implementation in 1992, many States and water systems adopted some sampling practices that do not meet the intent of the LCR and result in improper sample collection. These practices are:

- Removal of faucet aerators prior to collecting a sample;
- Practice of pre-stagnation flushing; and
- Use of sample containers with small openings affecting sample flow.

They can result in non-representative samples being collected that may significantly underestimate lead levels, inaccurately characterize the effectiveness of corrosion control treatment, and ultimately allow a potentially significant health risk to go undetected.

DOD Installation drinking water program managers and water system personnel should ensure that these practices are not part of their LCR sampling procedures and directions regardless of whether samples are collected by residents, contractors, preventive medicine, or Installation personnel. Table 2 summarizes the practices to avoid and provides recommendations for changing LCR sampling procedures and directions to ensure proper LCR samples are collected. Appendix B contains recommended directions for collecting LCR samples that includes language to ensure proper LCR sample collection. Installations are encouraged to check with State or Local regulatory authorities regarding additional provisions or requirements pertaining to proper LCR sampling practices.

Table 2. LCR Sampling Practices to Avoid and How to Avoid Them.

LCR SAMPLING PRACTICE	DO NOT…	DO…
Faucet Aerator Management	…Remove the aerator prior to collecting a sample. …Include language in sample directions that requires removal of the aerator.	…Leave the aerator untouched and intact prior to and during sample collection. …Include language in sampling directions that prohibits removal of the faucet aerator.
Pre-Stagnation Flushing	…Flush or run the water from the faucet prior to letting the water sit for at least 6 hours before sample collection. …Include language in sample directions that requires running or flushing the faucet prior to letting the water sit unused.	…Avoid intentionally flushing a faucet prior to letting water sit unused at least 6 hours before sample collection. …Ensure sampling directions do not include pre-stagnation flushing.
Sample Flow	…Prescribe a specific flow in sample directions. …Specify a low flow in sample directions.	…Include language in sample directions to collect a sample as though they were filling a glass of water or pot for cooking.
Wide-Mouth Sample Containers	…Use containers that are narrow-necked with small openings.	...Use wide-mouth containers with large openings.

POINT OF CONTACT

For additional information, contact the DOD Safe Drinking Water Act Services Steering Committee at email:
usaf.pentagon.af-sg.mbx.afmsa-sg3pb-workflow@mail.mil.

Dated: September 2017

APPENDIX A

References

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APPENDIX B

Recommended Directions for Residents Collecting LCR Samples

Recommended Directions for Homeowner Tap Sample Collection Procedures

These samples are being collected to test for lead and copper levels in your tap water. This sampling effort is required by the U.S. Environmental Protection Agency and your State under the Lead and Copper Rule, and is a collaboration between the public water system and their consumers (e.g., residents).

Prior arrangements will be made with you to coordinate the sample collection. Dates will be set for sample kit delivery and pick-up by water system staff.

Collect samples from your kitchen cold water tap (or bathroom cold water tap if it is usually used for drinking water). Be sure the tap WAS NOT used for at least 6 hours. The best time to collect samples is usually early in the morning before using the tap for the first time that day or in the evening upon returning from work when no water at all has been used (e.g., no toilet flushing, showering, etc.) To properly collect a sample please follow the steps below:

1. There must be a minimum of 6 hours during which there is no water used from the tap where the sample will be collected. During this time period, avoid using taps adjacent or close to that tap. For example don't run a dishwasher in the kitchen, or washing machine near a bathroom until after you take a sample. Either early mornings or evenings upon returning home are usually the best sampling times to ensure stagnant water conditions exist. Do not intentionally run water from the tap (i.e., flush the tap) before the start of the 6 hour period.
2. Use a kitchen or bathroom cold-water faucet for sampling. If you have water softeners or filters on your tap, collect your sample from a tap that is not connected to a water softener, or a filter, if possible. Do not remove the faucet aerator (the metal mesh on the end of the faucet where the water comes out) prior to sampling. Place the opened sample bottle below the faucet and open the cold water tap as you would do to fill a glass of water. Fill the sample bottle to the line marked "1000-mL" and turn off the water.
3. Tightly cap the sample bottle and place in the sample kit provided. Please review the sample kit label at this time to ensure that all information contained on the label is correct.
4. If you are aware of any plumbing repairs or replacement has been done in the home since the previous sampling event, note this information on the label as provided. Also if your sample was collected from a tap with a water softener or filter, note this as well.

5. Place the sample kit in the same location the kit was delivered to for pick up by the water system staff.
6. Test results from this monitoring effort and information about lead will be provided to you no later than 30 days after the water system staff receives the laboratory report. However, if excessive lead and/or copper levels are found, immediate notification will be provided (usually 1-2 working days after the system learns of the tap monitoring results).

Call _____ at _____if you have any questions regarding these instructions.

TO BE COMPLETED BY RESIDENT

Water was last used: Time Date

Sample was collected: Time _____Date_____

Sample Location & faucet (e.g. Bathroom sink): _____

I have read the above directions and have taken a tap sample in accordance with these directions.

_Signature _____Date_____

Call_____