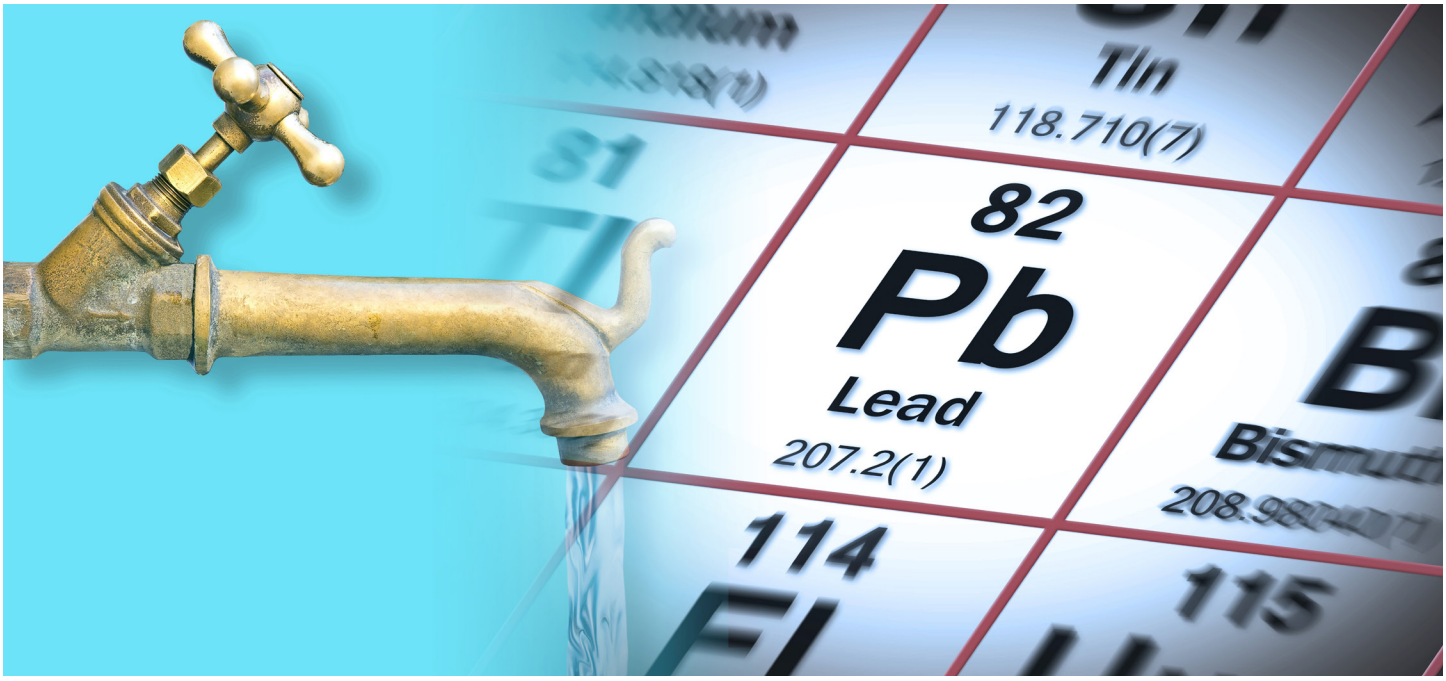
Benefits of Real-time Monitoring of Lead and Copper in Drinking Water Systems



The U.S. Environmental Protection Agency (EPA) has proposed the Lead and Copper Rule Improvements (LCRI) to significantly reduce exposure to lead through drinking water to further protect the health of children and communities. The proposal builds on the 2021 Lead and Copper Rule Revisions (LCRR) and the original 1991 Lead and Copper Rule (LCR). Under the LCRR, medium and large systems are required to install or re-optimize optimal corrosion control treatment (OCCT) in response to a lead or copper action level exceedance. Medium and large systems with lead service lines (LSLs) that exceed the lead action level are required to harvest lead pipes from the distribution system and conduct flow-through pipe rigs to evaluate options for OCCT or re-optimized OCCT. Large systems with corrosion control treatment (CCT) that exceed the lead practical quantification level may be required to re-optimize their OCCT. Large systems without CCT that exceed the lead practical quantification level are required to complete the steps to install CCT.

During the LCRI external engagements, EPA heard concerns about the complexity of the CCT requirements in LCRR and the requirement for pipe rig/loop studies, noting that pipe loop studies are resource intensive and that many water systems and states do not have experience implementing them (USEPA, 2023). Also, EPA heard about the uniqueness of each water system concerning CCT and that the CCT for each is different due to the water system's specific mix of plumbing materials and operations.

Real-time Lead and Copper Monitoring for System Compliance

The proposed LCRI regulation will rely more heavily on using lead and copper testing and monitoring apparatuses. This is where the benefit of real-time lead and copper monitoring in drinking water systems can significantly contribute to a water system's compliance with the proposed lead and copper action levels, 0.010 mg/L and 1.3 mg/L, respectively.

Since 1990, lead and copper testing and monitoring apparatuses have provided data representing the potential lead and copper exposure to consumers from buildings in the distribution system. Even though no two buildings have the same piping configuration and water usage patterns, the data from lead and copper testing/monitoring apparatuses' can be used to estimate the maximum potential lead and copper release in the distribution system. Technical literature has discussed the apparatuses, strategies, and data analysis techniques, identifying issues around sampling constraints. These apparatuses lack real-time data on water corrosivity to anticipate when changes will increase the risk of lead/copper corrosion before it happens in homes/schools/daycares at risk.

First, there must be a six-hour stagnation after the last flow in the apparatus before taking samples for lead and copper analysis. This stagnation imposes a sampling visit schedule on a workday.

Second, testing and monitoring programs using the apparatuses run for long periods, which stresses labor and laboratory budgets. Because of these stresses, lead and copper data are typically obtained once a week at a maximum and once a month at a minimum. As a result of this scarcity of data, many lead and copper release events are missed.

Third, tracking dissolved and particulate lead, not just total lead concentrations, is also essential. The same is true for copper. Different factors influence these metal fractions and must be studied separately, adding to laboratory expenses.

Automatic sampling and analysis of metal fractions solve these constraints since they facilitate one to three sampling events per day for stagnating apparatuses and approximately 24 sampling events per day for direct piping sampling. The high frequency of automatic sampling and analysis can economically capture more metal release events for all metal fractions (dissolved, particulate, and total).

The online MetalGuard™ analyzer from AMS enables real-time analysis of metal fractions of lead and copper. MetalGuard achieves lead or copper quantification in an aqueous matrix by differential pulse Anodic Stripping Voltammetry (ASV).

The automatic, unattended analyzer provides high-frequency, timely, and accurate predictive data to stakeholders on their exposure to lead or copper contamination risks. The operation of every MetalGuard system is supported with remote, 24/7 factory monitoring to ensure the quick identification and remediation of operational issues.

Table 1. MetalGuard™ Analyzer Features

Feature	MetalGuard™ Online Analyzer
Remote Health Monitoring	Yes
Service Level Metrics	Yes
Total Ownership Costs	$ (Low)
Accuracy/Repeatability	+/- 5%
Detection Limit	1 ppb
Sample Cycle	12/35 minutes
Self-Calibrate	Yes
Multiple Streams	5
Autonomy	90 days
Shelf-life of Agents	>90 days
Security of Supply of Reagents	Yes
Toxic Reagents and Waste	No
Health & Safety Requirements (E.g., Fume Hoods, PPE)	None
Warranty Period	5 Years

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