Comments for EPA's Science Advisory Board
On Partial Lead Service Lines
By

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The Greater Cincinnati Water Works is a municipally owned utility which serves drinking water to approximately 1.1 million people in the greater Cincinnati area. We do this with two treatment plants through 3100 miles of mains. Our system is an older system with the average pipe age of 50 years and some pipes dating back into the 1800's. We have 240,000 retail service accounts in our system. We stopped the practice of installing lead service branches in 1927. Nevertheless, we still have about 21,000 legacy lead service connections in our system.

We have optimized our corrosion control practices and have always been within the action level. Our lead 90th percentile from monitoring last year was 5.1 µg/L. We have even opted not to take advantage of reduced monitoring provision of the Lead and Copper Rule so that we can be sure that our frequent monitoring will capture any potential changes in the effectiveness of our corrosion control.

Because we are concerned with lead issues, we have an extensive lead research program which we have been conducting since the 1980's. Some of this work has been in conjunction with the USEPA as EPA's water research center is located in Cincinnati. However, we have also performed a lot of applied research on our own. Through this research in our system we have a good understanding of the make-up of our pipe scales, the variability of home to home and seasonal lead measurements in our system, the impact of some corrosion control treatments on dissolution of lead and the difficulty of finding any correlation between system measured lead levels and coupons, water quality parameters and other "predictors" of lead corrosion.

Much of the data currently out there on lead in real systems unfortunately comes from cases such as a few years ago in Washington are from systems that did not have optimized corrosion control at the time and there is a scarcity of data from systems with a well established corrosion control program. Therefore we believe having actual data from our own system has been very beneficial to us.

With this information we have made improvements designed to reduce the exposure of our population to lead. Because of our work looking at the new brasses with less than 0.25% lead, we were convinced of the reduced lead leaching and we became one of the first utilities in the country to specify these brasses in our meters and brass fittings. In fact, we recently replaced all of our 230,000 meters with meters made of this type of brass.

It was though this internal research program that we also became interested in the potential benefits of replacing part of the service line and the potential for an increase of lead for a limited duration during partial replacements. We initially collected some lead samples from places where a repair was required on lead service branches. With this data we saw that there were high lead values following the repair

work and most of the time flushing was successful in bringing the lead values down. Sampling 9 months later showed that these high lead values were no longer present in first draw samples.

We found this study intriguing and this lead us to take a look at a bigger sample size and be able to directly compare the results of the partial replacements side by side with doing no replacements and with doing full replacements. I have attached a copy of a paper from the Proceedings of the 2006 American Water Works Association Annual Conference where we presented this work. In this study, we identified 21 sites in our service area which had a history of detectable lead concentrations. At five of these sites we performed full lead service line replacements, at five sites we performed partial service line replacements, in six sites we performed partial service line replacements where we put a Teflon sleeve on the end of the lead service line which acted to cover the freshly cut end, and at five of the sites we performed no service line work. We then collected first draw samples at these sites before the work was performed, at one week after the work, and monthly for one year after the work was performed. Specific details of the study can be found in the accompanying paper, but in summary, performing partial service line replacements resulted in a spike in lead concentrations in 4 of the 11 sites studies. The spike in the first draw lead lasted for somewhere between one week to one month. Within one month, the lead levels were seen to drop back down to a baseline level.

Although the lead levels did come down within one month, by comparing the lead levels at the partial sites to the sites at which no work was performed, we saw that the lead levels were similar in the one year study. The full replacement sites, though, showed significantly lower lead levels than the partial and no work sites. This indicated to us that doing partial replacements did not result in long-term benefit in lead levels, at least up to one year after the work and the only full lead service replacement was successful in reducing lead levels nor did it result in higher lead levels. In addition, not only do partial replacements offer no long-term change in lead levels, but they can result in short-term spikes in lead.

This partial replacement work was later confirmed in a Water Research Foundation report by Sandvig et al. (2008). In that work, the authors reported short-term high lead values were also seen following partial as well as full lead service line replacements. In addition, they found that the short-term spikes could be attributed to particulate lead. From these results it can be concluded that these short-term spikes occurred as a result of the physical disturbance of digging at the site, the vibration of the heavy equipment and physically handling and cutting the lead service branch.

Before we completed our partial service branch changeover study, GCWW had a program of proactively replacing our portion of the lead service line, from the main to the meter in which we replaced about 400 lines per year in an attempt to “get the lead out.” Once we saw the results of our study we stopped the practice of doing partials just for the purpose of removing lead lines. However, there are times when performing partial replacements is necessary such as main replacement and other street infrastructure work such as sewer replacements, street realignment, and necessary repairs on mains or service branches. In 2008 we performed a total of 230,000 feet (44 miles) of main replacement just as part of the normal main replacement and CIP programs. If we were to eliminate the projects that included lead service lines, then we would not have been able to do about 27% of the work. In 2009 the

numbers were 144,000 feet (27 miles) with 37% in projects associated with lead service lines. There is no question that water main replacement needs to be done to ensure we are able to successfully deliver an adequate supply of water to support not only household consumption, but also to provide fire flow and maintain system integrity.

GCWW Infrastructure Projects with Lead Lines

	Feet of Main Installed	% in Projects with Lead Service Lines
2008	230,000 (44 miles)	27%
2009	144,000 (27 miles)	37%

Through this program of replacement only when necessary, on average over the last 10 years, we have replaced about 1% of our portion of the lead service lines per year. When we have to do these replacements we implement what we believe to be some best management practices during the process. These practices include using a clean cutting tool rather than a hacksaw in order to minimize lead dust and physical disruption, we now use specialized lead to copper fittings rather than soldering the lead and copper directly together in an effort to reduce galvanic corrosion, and we do some flushing of the line when possible to remove particulates created during construction. In addition, in all of these cases except for the unplanned repair, we notify the customers a minimum of 30 days before the work with information about lead in drinking water and the risks of lead. We also suggest that they take this opportunity to also replace their portion of the lead service line at the same time and we also provide door hanger notification before the work is actually performed. It is an extremely rare occurrence when a customer does replace their portion of the service line because of the cost ($2,000 to $5,000). In the case of unplanned repairs, we provide door hangers and follow-up information on lead. We also offer to test the water after a planned or unplanned replacement, but we are seldom taken up on our offer. If testing reveals a high lead value, we will work with the customer to identify solutions to minimize lead exposure.

As a city owned utility, we are prohibited from going onto private property to make improvements. Nevertheless, we have made some estimates for replacing customer portion of the service lines. At an average cost of $3,500, replacing just the customer's portion of our lines would be $73,500,000. Total line replacement with GCWW's portion plus the customer portion would cost $126,000,000.

In conclusion, legacy lead service lines are a recognized problem that is experienced by a significant number of utilities in the U.S. like Cincinnati. Unfortunately, regardless of any law or regulation, utilities find themselves in a situation almost daily when they have to deal with lead lines by way of an infrastructure project or a necessary repair which necessitate partial replacements. Since the customers are overwhelmingly resistant to replacing their portion of the line even when given information on lead health effects, utilities have limited realistic opportunities to reduce lead exposure in these situations and must rely on best management practices and public education to reduce lead exposure.