

Lead in Potable Water Pipes

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This year, the Wisconsin DNR was authorized by the US Environmental Protection Agency (EPA) to offer grants to help property owners replace lead pipes. The grant covers the portion of the water delivery system that is the responsibility of the property owners—from curbside to the water meter. The grants were awarded to cities with an overall plan to replace lead pipes throughout the water delivery system, not just the final delivery to homes. Partial line replacement often results in an initial increase of lead levels in drinking water. Once awarded, the WI DNR grants are managed by the cities. Fond du Lac was one of 38 cities to receive a grant this year. The size of the grant is dependent on the size of the population being served and disadvantaged income levels in the municipality, Fond du Lac received \$300,000.

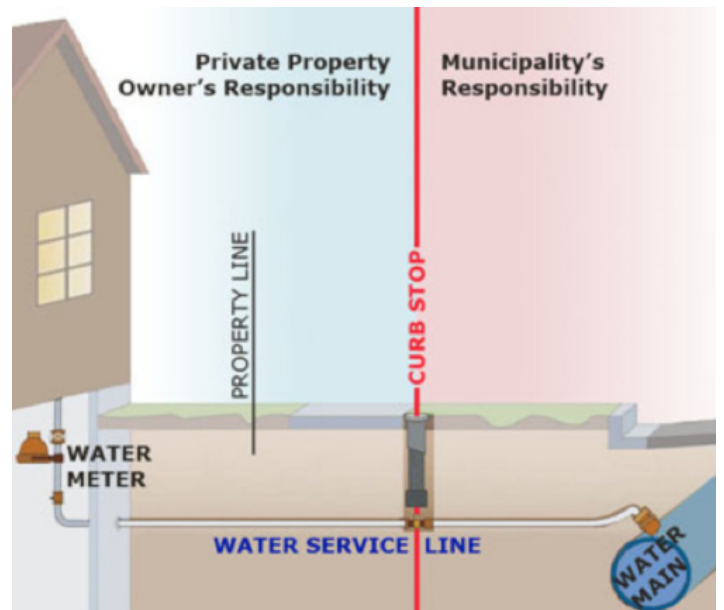
More information about the Wisconsin grants can be found at <http://dnr.wi.gov/Aid/documents/EIF/leadServiceLineFunding.htm>.

Fond du Lac is using the grant to offer half the cost of replacing the property owner's service line, up to \$2000. A state-wide estimate for average cost is \$3000 for the private line replacement. The offer is good for projects that are completed by 30 September 2017, for this year. The city has three years to use all the money, if grant money remains after this year's projects, the city will work to fund more projects over the next two years. There is a process to apply for the grant. First, contact the City Water Department Business Office at (920)322-3680 to express interest. Next, a plumber from the city's pre-qualified list must be used to perform the project and receive the grant.

The list is available at https://www.fdl.wi.gov/cofuploads/2017_Prequalified_Plumber_List_5222017075131.pdf.

It is recommended that at least two quotes be solicited before beginning the project. Finally, before work begins, a form explaining the grant, signed by the owner and plumber, is submitted to the city. After the project is complete, the plumber will submit a second, final, form to request payment from the grant.

More information about the city's program can be found at <https://www.fdl.wi.gov/departments.iml?DeptID=&DeptPage=219>.



There are several properties of lead that contributed to its use for plumbing ever since ancient times. In fact, the term plumbing comes from the Roman word for lead, plumbum. Lead's malleability (ability to be pounded into shape) and low melting point, 621 °F (compared to 1984 °F for copper), makes it easy to shape into pipes. It resists formation of pin-hole leaks, minimizing loss of water. The lead lined pool in Bath England, built by the Romans prior to AD 300, still holds water. Unlike iron, but like aluminum, lead resists corrosion (also known as oxidation). When iron corrodes to form rust, the rust flakes off the remaining iron, exposing new surfaces that can continue to rust. The surface of lead does corrode, turning the pure lead from a bright silvery-blue to the dull grey color of lead oxide. However, this layer of lead oxide does not flake off, it does not expose new layers of lead. Oxygen is prevented from penetrating deeper into the lead and the interior of the pipe is protected from further reaction. Lime and ortho-phosphates can also be added to water to further protect the inner surfaces of lead pipes from corrosion. Because of its corrosion resistance, lead is still used as a lining for containers holding corrosive acids, like sulfuric acid. However, lead will corrode under alkaline conditions and when exposed to hydrochloric, acetic, and nitric acids.

The ability of hydrochloric acid to corrode lead is what contributed to Flint, Michigan's problems with lead in their drinking water. It started with trying to save money. The city decided to change the source of their drinking water, during the transition between sources, the city used water from the Flint River. Water from the Flint River delivered to homes became contaminated with E. coli. To control the contamination the city increased chlorination of the drinking water, a common way to control bacterial contam-

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ination. Without additional anti-corrosion additives, the increase in chlorination led to increased corrosion of the lead drinking water service lines and higher levels of lead in the drinking water.

The biggest concern about lead toxicity is its effect on nervous tissue—the transmission of nerve signals, though other tissues may be affected. The brain is not fully developed until at least the early teen years, so a developing fetus and young children are more susceptible to lead poisoning than adults. The toxicity of lead in high concentrations was suspected since ancient times. However, the toxicity of low doses of lead took much longer to discover. The toxicity of very low levels was demonstrated in 1979 by Dr. Herbert Needleman. Besides affecting nervous tissue, small amounts of ingested lead collect in bones and teeth. Dr. Needleman collected “baby teeth” from first and second graders in Boston and gave those children an IQ test. Those with the highest levels of lead in their teeth scored much lower than those with low lead levels. Research conducted since Dr. Needleman’s original work shows lead contributes to a wide range of learning disabilities, anti-social behaviors, and mental health disorders. Without this knowledge, the Romans added low levels of lead to wine to make it taste sweeter. Lead paint was used in many homes until a ban was placed on lead paint in 1978. Paint chips containing lead also taste sweet, which makes it a hazard for young children in many older homes. It took until 1996 before lead containing additives, anti-knock agents, were completely removed from gasoline. Before then, car exhaust put lead fumes into the atmosphere.

Unused drinking water, dish water, and toilet water all end up in the sewer system for processing at water treatment facilities. Any lead in the drinking water may become part of the final discharge from that plant. There are no regulations that limit lead discharge from the Fond du Lac water treatment facility, however, lead levels of the water entering and discharged from the facility are monitored. According to Autumn Fisher, the plant’s Superintendent, lead levels in water entering the treatment plant average about 4 parts per billion and water leaving the plant averages about 1 part per billion. Safe drinking water levels are set at 15 parts per billion. In addition, some solids generated at the facility are beneficially reused as fertilizer. This must be monitored for lead and may have a maximum of 300 milligrams of lead in each kilogram (2.2 pounds) of solid.

The plant’s biosolids level has averaged 20 mg lead per kg of solid, well below the maximum allowed.

I could not find any data for Lead levels in Lake Winnebago. In the Wisconsin impaired waters list, the Fond du Lac River contains “unspecified metals” (<http://dnr.wi.gov/water/impairedSearch.aspx>). A source of lead in lakes and rivers is lead in bird-shot and fishing line sinkers. In 1992 lead shot was banned for hunting water fowl. The most significant hazard of lead shot and sinkers left in water is direct ingestion—eating it. The lead does not significantly dissolve into the water over time. A 2008 review by The American Fisheries Society and The Wildlife Society suggests that fish do not ingest lead shot or sinkers. The National Wildlife Center evaluated different types of water fowl and found that diving ducks are at greatest risk for ingesting these sources of lead. Predator birds, eagles and hawks, and scavengers are at risk of ingesting lead from animals injured or killed with lead ammunition, where the lead ammunition remains in the animals. In Wisconsin, a study published in 2009 attributed 25% of all Trumpeter Swan and 15% of Bald Eagle deaths to lead toxicity. The city of Fond du Lac is moving forward to protect our drinking water before there is a problem. Previous uses of lead, from solder and paint to gasoline additives, have been changed to reduce risk of exposure to lead. Continuing studies are investigating the environmental effects of lead shot for birds not near waterways and may lead to further reductions in use of leaded ammunition. In all, reduction of lead in our environment is leading to a healthier life not just for us, but wildlife as well.

Next LWQIA Meeting:
Wed., November 1, 2017
7 p.m.
FDL City/County Building
160 S. Macy St.

“The public is welcome”

Sources and Further Reading:

<https://www.britannica.com/science/lead-chemical-element>

<https://www.gsa.gov/portal/content/112542>

<https://www.livescience.com/39304-facts-about-lead.html>

<http://www.pbs.org/newshour/rundown/how-a-doctor-discovered-us-walls-were-poisonous/>

https://www.nwhc.usgs.gov/disease_information/lead_poisoning/

http://fisheries.org/docs/fisheries_magazine_archive/fisheries_3305.pdf

<http://dnr.wi.gov/topic/hunt/documents/pbbirds.pdf>

https://www.nwhc.usgs.gov/disease_information/lead_poisoning/

<http://dnr.wi.gov/Aid/documents/EIF/leadServiceLineFunding.html>