INTEGRATED WATER RESOURCE MANAGEMENT CASE STUDY:

MADISON LEAD PIPE REPLACEMENT PROGRAM

PROJECT SUMMARY

The Madison Water Utility replaced all 8,000 lead service lines in its water system during an 11-year project period (2001-2012) in which approximately $15.5 million was spent.

WHAT HAPPENED?

Problem Statement and Project Goal

In 1992, the City of Madison, Wisconsin found elevated lead levels in its drinking water supply. The City of Madison decided to address the issue through a water service line replacement program. Because one portion of a water service line is owned by the City, and one portion is owned by the building owner, the program required collaboration between the water utility and residents (see Issue Brief: Lead). The City replaced the publicly-owned portion of lead service lines, and required building owners to replace the privately-owned portion. Between 2001 and 2012, the program successfully replaced all lead service lines in the City of Madison.

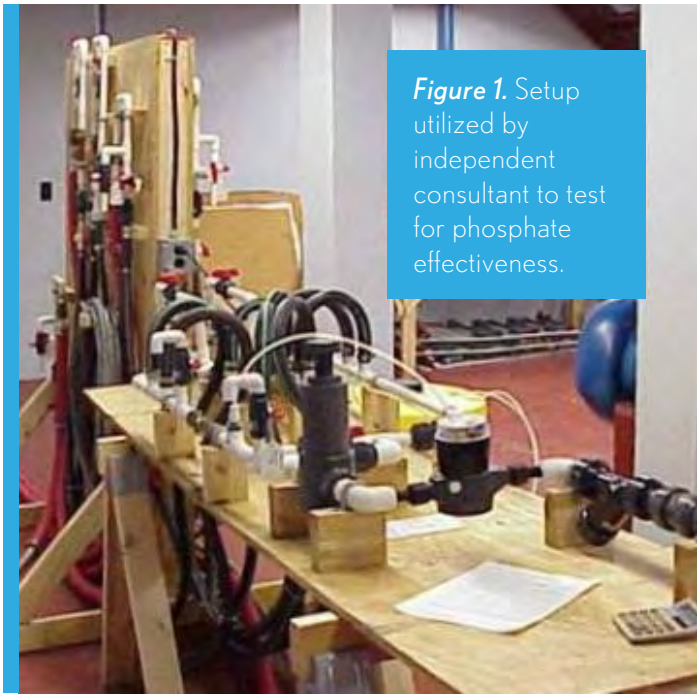

Figure 1. Setup utilized by independent consultant to test for phosphate effectiveness.

Drivers that spurred on the Project/Program: ***What lifted the project off the ground?***

- ☐ Community Demand
- ☐ Policy
- ☑ Politics
- ☑ Practitioners
- ☐ Financing
- ☐ Unclear
- ☑ **Other:** The project was driven by the findings of the consultant which influenced city/utility officials to enact policy removing all lead pipes.

Challenges/Barriers to adopt: ***What was/were the challenges to moving the project forward?***

- ☑ Community Demand
- ☑ Policy
- ☐ Politics
- ☐ Practitioners
- ☑ Financing
- ☐ Unclear
- ☑ **Other:** Community backlash due to inadequate information regarding the danger of lead pipes was strong, but rebates to homeowners for the private portions helped combat this barrier.

Proponents: ***Was the public/private/ combination behind this project?***

- ☑ Public
- ☐ Private
- ☐ Combination

Public: As mentioned above, the city and utility drove the project despite private opposition.

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HOW DID IT HAPPEN?

Ingredients for Success: Drivers and Barriers

In 1992, the City of Madison began testing its drinking water for lead, as mandated by the U.S. EPA's Lead and Copper Rule. After elevated lead levels were detected, the Madison Water Utility considered two options. The water utility could either reduce the level of lead through the addition of phosphates, or replace all water service lines which contained lead pipe. The water utility decided to test the effectiveness of phosphate, hiring an outside chemist to conduct a comprehensive four-year water testing program. At the conclusion of the testing program, the chemist found that not only would the added phosphate create algal blooms in nearby lakes, but it would fail to lower lead concentrations to required levels. Based on the results of the phosphate testing, the City opted instead to proceed with a service line replacement program.

Some residents opposed the lead service line replacement program due to the cost of the program and skepticism about the health risks of lead in water. Elected City officials, including the Mayor and Common Council, supported the program in two ways: financial incentives and legislation. The water utility offered partial rebates to affected building owners, to help defray the cost of service line replacement. Property owners were reimbursed for 50% of the cost of replacing their portion of the water service line, up to $1,000. Other ingredients for success include Madison's foresight in prohibiting lead pipes in 1928, nearly 30 years before other cities in the region.

System Specifications, Scale (of system and project), and Cost

Madison's water is sourced from a deep aquifer beneath the city. The Madison Water Utility, a public water system owned and operated by the City of Madison, provides water services to more than 250,000 people throughout the metro area. The water infrastructure includes 828 miles of water main. The lead service line replacement program replaced more than 8,000 pipes. The total cost of the replacement program was $15.5 million over 11 years, in addition to any costs paid by property owners after reimbursement. The average cost to replace the public side of one lead service line was $1,997. The average cost to replace the private-side portion of one service line was $1,340, with the reimbursement averaging $670.

Figure 2. Madison Water Utility crews replace lead service lines in 2001.

Beneficiary

The program benefited all Madison residents who were previously at risk to lead exposure from lead-containing water service lines. The region's lakes also benefited, by avoiding water quality impairment from phosphate additives.

Decision-Making Timeframe

1992: Lead testing of drinking water; elevated lead levels found *(funding source: water rate revenue)*

1992-1996: Phosphate effective testing program; phosphate found to be insufficiently effective *(funding source: water rate revenue)*

2000: Madison Common Council approves ordinance requiring property owners to replace lead pipes

2001-2006: Lead Pipe Replacement program removes 80% of the 8,000 lead service lines in the city *(funding source: water rate revenue; property owner investment; cell tower hosting income)*

Initiated 2003: Assessment of Lead Pipe Replacement program

2007-2012: Lead Pipe Replacement program removes final 20% of the 8,000 lead service lines in the city *(funding source: water rate revenue; property owner investment; cell tower hosting income)*

2011, 2014, 2017: Madison Water Utility continues to test for elevated levels of lead under EPA's Lead and Copper Rule *(funding source: water rate revenue)*

Funding, Financing, and Management: Mechanisms, Timeframe

Water rate revenue was used to finance replacement of the public portion of service lines. Between 2001 and 2006, the capital annual budget was between $7 million and $9 million. During those years, approximately $1 - 1.5 million was spent annually on the program. After 2006, the amount spent on lead service line replacements dropped to less than $100,000 annually.

Property owners contributed at least 50 percent of the cost to replace the private portion of their service line. Finally, the partial reimbursement to participating property owners was funded by revenue from renting space on water towers to cellphone companies.

DID IT WORK?

Maintenance, Monitoring and Outcomes

In 2003, Madison Water Utility initiated a special project to assess the success of the lead line replacement program in terms of achieving corrosion control. The study found lead to be present in plumbing systems for 3 to 4 years after the pipe replacement occurred. The data suggest that lead-laden particulate matter is flushed out of the system over several years after lead materials are removed from the plumbing system.

At the conclusion of the lead pipe replacement program, the Madison Water Utility conducted water testing at one hundred residences, to prove compliance in two successive six-month periods. Based on the favorable testing results, the Madison Water Utility has been authorized to conduct reduced monitoring for both lead and copper in drinking water. This status requires testing for lead and copper every three years instead of every year. Sampling occurred again in 2014 with favorable results, and is scheduled to occur in 2017.

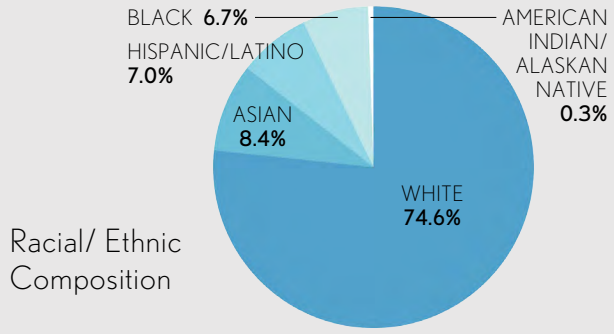
Although all known lead service lines were replaced as of 2012, lead service lines are still discovered occasionally. When this happens, Madison Water Utility will still offer property owners a reimbursement for half the cost of up to $1,500. Property owners can also apply for financing through the City, to help pay for the costs owed.

Lessons Learned

Currently, federal regulations require only replacement of utility-owned lead pipes. However, disturbing publicly-owned pipes during a partial service line replacement can release lead-containing particulates into the drinking water supply, causing increased lead levels, according to the CDC. In addition, the privately-owned portion of the service line, if not replaced, will continue to release lead into the drinking water. The most effective strategy for eliminating lead exposure is to replace public and private water service lines simultaneously.

A lead prevention education campaign should be implemented prior to the program, and continue for several years after the program concludes. An education campaign will both foster community buy-in for the program, as well as protect residents' health after lead particulates are released during service line replacement.

COMMUNITY FACTS
MADISON, WISCONSIN



Racial/ Ethnic Composition

Population 2016	246,034
Population change since 2010	+8.3%
Median Age	30.8 years
High School graduate or higher	95.2%
Total housing units	110,540
Median Household Income	$56,464
Individuals below poverty level	18.6%

Features: **Madison is the state capital, and the home of several major universities.**

SOURCES

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2. Dennis, Fears (2016). "One city's solution to drinking water contamination? Get rid of every lead pipe." *The Washington Post*. https://www.washingtonpost.com/national/health-science/one-citys-solution-to-drinking-water-contamination-get-rid-of-every-lead-pipe/2016/05/10/480cd842-0814-11e6-bdcb-0133da18418d_story.html
3. "EPA looks to Madison as leader on lead pipe issue." (2016). *City of Madison*. https://www.cityofmadison.com/water/insidemwu/epa-looks-to-madison-as-leader-on-lead-pipe-issue
4. "Lead & Copper in Water." City of Madison. (2016). https://www.cityofmadison.com/water/water-quality/water-quality-testing/lead-copper-in-water

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