



**HARVARD**  
**T.H. CHAN**

**SCHOOL OF PUBLIC HEALTH**  
Prevention Research Center  
on Nutrition and Physical Activity

## **Safe Home Drinking Water: A Series of Six Case Study Briefs**

### *Executive Summary*



## **THE ISSUE**

Water security means having stable access to available, acceptable, and safe drinking water and it is key to supporting good nutrition and health. Water security is particularly important for families with formula-fed infants because powdered infant formula is reconstituted with plain water. Families with low incomes, communities of color, and non-native English speakers are disproportionately affected by exposure to unsafe drinking water.



## **THE CASES**

This series of case studies describes six state and local strategies to address equitable home drinking water access and quality for families with children 0–5 years old experiencing low income. Researchers interviewed key informants about the community context, supportive policies, program design, program activities, and lessons learned. The cases highlight programs and policies for home water quality testing, home well water treatment device installation, filter pitcher distribution, and lead service line (LSL) replacement. Partnering with organizations with established relationships with families vulnerable to unsafe drinking water like the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was a key program activity.

### **New Jersey Private Well Testing Act**

*State policy requiring home well water quality testing when a property is sold and every five years for rental properties served by wells.*

### **Well Testing Via Healthcare Clinics in New Hampshire and Vermont**

*Local program that educated primary care clinical providers to conduct screenings, offer home well water testing for arsenic at no charge to families with infants, and conduct follow-up reminders.*

### **New Hampshire's Water Well-Ness Initiative**

*State-wide initiative training WIC clinicians to conduct screenings of pregnant people, offer home well water testing, and, if needed, provide filter pitchers and filter cartridges free of charge.*

### **Porterville, California Program**

*Local program that provided water sampling and testing services for nitrate along with associated education, water filtration systems, and bottled water delivery to WIC-eligible families free of charge via community organizations and a local WIC office.*

### **Cincinnati's Enhanced Lead Program**

*Local ordinances prohibiting private LSLs and providing local financing and subsidies for private LSL replacements.*

### **Denver Water's Filter Program**

*Local water utility program providing filter pitchers and replacement filter cartridges appropriate for household water needs free of charge to all properties with a known or suspected LSL. Program activities included the use of LSL inventory and demographic data to identify neighborhoods with high concentrations of pregnant people and young children, outreach to leasing agents, and provision of filter kits to apartment complexes for distribution to new tenants.*

# IMPLICATIONS

The lessons learned from these policies and programs can inform equity-based efforts to improve water security with a focus on young children in households experiencing low incomes.



## Equity framework to increase water security at home

### *Opportunities for Policy and Systems Change*



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# Case Study Brief: New Jersey Private Well Testing Act



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# INTRODUCTION

This case study describes implementation of the New Jersey Private Well Testing Act (PWTA), a statewide policy, and how groundwater quality data collected as a result of the policy has supported efforts to address private well water quality in New Jersey. Approximately 1.2 million New Jersey residents rely on 400,000 private wells for drinking water.<sup>1,2</sup> Unlike public water systems, which are regulated by the Safe Drinking Water Act, there are no federal laws requiring that private wells be tested for water contaminants. New Jersey enacted the PWTA in 2001 in an effort to address this policy gap and to raise awareness about private well water quality. The PWTA states that the untreated groundwater from a private well providing potable drinking water to a home or business should be tested by a state-certified water

analysis lab every five years for rental properties and each time a property is sold. Compliance with the PWTA is required, but the statute does not contain any enforcement mechanisms. State-certified laboratories conduct the testing and submit test results both to the client that arranged for the test and directly to the New Jersey Department of Environmental Protection (NJDEP). NJDEP has used the data collected during implementation of the PWTA to build a statewide database of groundwater quality. This database has helped build community capacity to better address private residential well water quality in New Jersey. The lessons learned from the PWTA can be used to inform other state and local agencies that may undertake monitoring of private well water quality.

*This case study is part of a series of six descriptive case studies of state and local safe home water access policies and programs. The research team collected and reviewed available background materials for each case and conducted semi-structured interviews with key informants about relevant community context and policies, program design, program implementation, and lessons learned. All six case studies and a summary report are available at: <https://www.hsph.harvard.edu/prc/projects/safe-home-water>*

*The research team also developed and compared estimates of the population reach and costs for widespread implementation of each case study policy or program based upon the prevalence of families with children 0-5 experiencing low income with concerns about tap water and/or lack of access to safe home tap water.*



## POLICY RATIONALE

Initially, the PWTA was motivated by the lack of testing requirements for existing private wells and concerns about groundwater contamination from New Jersey's high number of toxic spills and superfund cleanup sites.<sup>3</sup> Private well water quality data reported to the NJDEP since the PWTA became effective in 2002 has shown that naturally occurring groundwater contaminants

like arsenic and gross alpha (a measure of radioactive elements) are more prevalent than the manmade contaminants that originally motivated adoption of the policy.<sup>3</sup> As a result, naturally occurring groundwater contaminants are now the focus of water quality research and outreach efforts with private well users in the state.<sup>2</sup>



## COMMUNITY PARTNERS

The PWTA requires that NJDEP collaborate with state-certified laboratories,<sup>4</sup> local health authorities,<sup>5</sup> and the state Drinking Water Quality Institute.<sup>6</sup> Water samples must be collected and tested by state-certified laboratories and reported directly to NJDEP.<sup>7</sup> The NJDEP must notify local health authorities when there is a contaminated well in their jurisdiction.<sup>5</sup> The NJDEP also must consult with the Drinking Water Quality Institute to establish additional parameters for water contaminants of concern for inclusion in the PWTA testing requirements.<sup>6</sup> The Drinking Water Quality Institute was established in 1984 and is responsible for developing water quality standards for hazardous contaminants in

drinking water and for recommending those standards to NJDEP.<sup>8</sup> NJDEP has developed strategic partnerships beyond those required by the PWTA with the New Jersey Department of Health, public health researchers at the Lamont-Doherty Earth Observatory at Columbia University, environmental commissions, school boards, and local healthcare systems.<sup>2,9</sup> As discussed below in the PWTA Results and Findings section, these strategic partnerships have led to additional programming to address private well water quality in the regions of New Jersey identified by PWTA-required testing as having a high risk of groundwater contamination.



## PROGRAM FINANCING

When the PWTA was enacted, the NJDEP received a new \$1,000,000 appropriation from the New Jersey “Safe Drinking Water Fund” to administer the statute.<sup>10(p5),11</sup> For ongoing financing, the PWTA directs the NJDEP to include a “sufficient sum” to administer the statute in its annual budget request to the state legislature.<sup>11</sup> To pay for the

water quality testing itself, the PWTA requires the private parties pay to test for the required parameters at an estimated cost of \$1,250 per well. There was no new funding appropriated directly for the discretionary activities of local health authorities contained in the PWTA.<sup>10(p5)</sup>



## KEY ACTIVITIES REQUIRED BY THE PWTA

The goal of the PWTA “is to ensure that purchasers and lessees of properties served by private potable wells are fully aware of the quality of the drinking water source prior to sale or lease of a home or business.”<sup>12(pv)</sup> The key activities required by the PWTA are:

1. Periodic review of contaminants to be tested for in different parts of the state by NJDEP
2. Well water testing by a state-certified laboratory of rental properties every five years with tenant notification (landlord pays for testing); and whenever a property is sold (buyer or seller pays for testing)
3. Submission of test results from state-certified laboratories to the NJDEP

4. Notification of the local health authority of water quality test failures by the NJDEP
5. Optional notification of nearby private well owners by the local health authority when a home with a contaminated well is identified by PWTA-required testing
6. Public disclosure by NJDEP of de-identified, aggregated test results

Notably, the policy does not contain any enforcement mechanisms authorizing NJDEP to compel testing or notification.

## Regulated Contaminants

The PWTA's current requirements specify that all properties with a potable drinking water supply from a private well must test their untreated well water for total coliform (and E.coli if total coliform is present), nitrate, iron, manganese, pH, volatile organic compounds (VOCs) lead, arsenic, and gross alpha particle activity.<sup>13</sup> The statute authorizes NJDEP to conduct rulemaking to develop additional requirements for contaminants it deems to be of "significant" health concern in each county (e.g. mercury and uranium) in consultation with the state's Drinking Water Quality Institute.<sup>13</sup> For example, in 2018 the NJDEP expanded the PWTA's arsenic testing requirement to all counties statewide,<sup>14</sup> and in 2020, the PWTA was further expanded to include statewide testing for PFOS, PFOA, and PFNA.<sup>15(p2.1(a)(12))</sup>

## Testing & Notification

The PWTA requires that all water sampling and testing be conducted by a state-certified water analysis laboratory.<sup>4</sup> For rental properties, the landlord is responsible for arranging and paying for testing every five years.<sup>16</sup> A written copy of the most recent test results must be provided to each rental unit and the most recent test results are to be provided to new tenants.<sup>16</sup> For property sales, the buyer and seller determine who will be responsible for arranging and paying for water testing.<sup>17</sup> The real estate closing must include a copy of the test results and a disclosure signed by both the buyer and seller that they have received and reviewed the results.<sup>18</sup>

## Data Collection & Publication

State-certified laboratories transmit to NJDEP test results with address information and a

GPS identifier for the property sampled.<sup>15(p7.9E-3.1(a))</sup> Agency staff then de-identify the results and aggregate the data to evaluate trends in groundwater quality.<sup>10</sup> NJDEP reviews and corrects errors in PWTA data submitted by laboratories (e.g. incorrect GPS coordinates for the address provided) and periodically issues public reports of aggregated test results.<sup>10</sup> Specific addresses and location information of properties sampled are kept confidential.<sup>19</sup>

## Role of Local Health Authorities

Under the PWTA, local health authorities have the option to notify properties in the vicinity of a private well that has exceeded a maximum contaminant level in order to encourage testing of other private wells in the area.<sup>5</sup> If a local health authority opts to notify neighboring properties, it must, at a minimum, notify property owners within 200 feet of the property line of the property with the contaminated well and it must keep the location of the property with a contaminated well confidential.<sup>15(p7.9E-4.2(c))</sup> These are discretionary activities as they are not required by the PWTA.



# PROGRAM DESIGN STRATEGIES TO REACH PREGNANT PEOPLE AND FAMILIES WITH YOUNG CHILDREN

The PWTA itself is a universal requirement and does not explicitly contain elements designed to prioritize pregnant people or families with young children. A study of private well water testing for arsenic in New Jersey before and after enactment of the PWTA did find that:

“Although the PWTA did not intentionally target biologically susceptible groups such as pregnant women and families with children, such households are more likely to be buying homes, and in turn, the policy has an unintended benefit. Indeed, those who have purchased homes more recently are in general younger (median age 49 vs. 61), of higher income (median household income \$125–150,000 vs. \$100–125,000), and more likely to have children in the home than those who purchased their homes prior to the PWTA (60% vs. 32%).”<sup>9</sup>

The statute’s lack of enforcement mechanisms, however, indicates that families with children living in rental properties may be less likely to benefit from the policy. For example, a follow-up study of households with PWTA test results that exceeded the maximum contaminant level (MCL) for arsenic in an affluent region of New Jersey found that just 2 percent of respondents were renters.<sup>20(p13)</sup> However, as described below, the statewide well water quality data collected by the PWTA has helped to build community capacity to address private well water quality with an emphasis on families with young children regardless of whether they own or lease their home.





# PWTA RESULTS AND FINDINGS

The section will discuss the PWTA test results, research findings about whether PWTA testing results in private well water treatment, and private well water quality initiatives that have been informed by PWTA data.

## Test Results

From when PWTA testing began in 2002 to 2018, about 28 percent of the approximately 400,000 private wells in New Jersey have been tested (Table 1).<sup>2</sup> In other words, after 19 years of PWTA implementation, there are still about 289,000 private wells that have not been tested pursuant to the PWTA. It is unknown how many of the properties that were tested are homes or businesses, nor how many wells were tested during a real estate transaction or to comply with the periodic testing requirement (every five years) for rental properties.

Statewide PWTA testing data from 2002–2018 found that 14.5 percent of wells tested demonstrated an exceedance for at least one contaminant of health concern (Table 1). An analysis of PWTA data from 2002–2014 found that wells often exceeded the state MCL for more than one contaminant, and that the most common exceedances were for gross alpha (10.1 percent) and arsenic (8.9 percent).<sup>2</sup>

## Impact of PWTA Testing on Home Well Water Treatment

The PWTA does not require water treatment or mitigation if an exceedance is found. A survey of

well owners with arsenic above the New Jersey MCL of 5 ppb identified during PWTA-required testing found that 28 percent of surveyed households did not take any action to reduce arsenic exposure.<sup>9</sup> Of the 72 percent of surveyed households that did take action, 31 percent installed a new treatment device, 33 percent used an existing treatment device, and 8 percent reported that they avoid drinking their tap water (e.g. drink bottled water).<sup>9</sup>

The survey also compared participants' actual PWTA test results with responses to questions about the household's water quality and water treatment steps taken. It found that participants did not accurately remember their arsenic test results and often did not know what treatments they were using.<sup>9</sup> For those that did have a treatment system, many described inadequate maintenance and monitoring of their treatment system (e.g. no routine maintenance scheduled).<sup>9</sup>

**Table 1: PWTA Test Results (2002–2018)<sup>14</sup>**

Estimated number of private wells in New Jersey	400,000
Number of private wells tested to comply with PWTA	111,011
Percent of wells tested with at least one exceedance	14.5%
Percent of wells tested with a gross alpha exceedance	10.9%
Percent of wells tested with an arsenic exceedance	8.3%

## Use of PWTA Data to Inform Targeted Well Water Quality Programming

The NJDEP’s statewide database of groundwater quality has informed focused outreach and free water testing for households with a private well in regions of the state with a high “fail rate” for contaminants like arsenic.<sup>2</sup> For example, the Kingwood Township Environmental Commission and the NJ Geological and Water Survey offered free well water testing via schools in a region of the state identified as a hotspot by PWTA testing for arsenic and boron.<sup>2</sup> The program sent a water test kit and educational materials home with students and asked them to bring the sample back to school.<sup>2</sup> The program collected samples from 376 private wells in one week and found that 25 percent of the wells tested exceeded the state MCL for arsenic and 5 percent exceeded the EPA Health Advisory Level for boron.<sup>2</sup>

Another free testing initiative was carried out by the Hunterdon Healthcare System in collaboration with Columbia University researchers in an area of New Jersey with a high fail rate for arsenic in groundwater.<sup>2</sup> The program distributed educational materials and free water test kits to five healthcare clinics, and conducted additional outreach through the mass media and targeted social media marketing (Table 2). The majority of households that took advantage of the free water quality testing were families with children (75.3 percent).

**Table 2: Results of Hunterdon Healthcare and Columbia University Free Testing Initiative<sup>2</sup>**

Tests Provided	807
Samples Returned	433
% Arsenic Exceedance	10.9%
% Families with Children	75.3%
% Household with a Pregnant Person	7.9%



# PWTA IMPLICATIONS

New Jersey's PWTA is a unique approach to require private well water testing in the United States.<sup>3</sup> The statute was designed to be a consumer information law for people purchasing or leasing real estate. The provisions of the PWTA that make well water quality testing a required step in the real estate closing process have resulted in the vast majority of PWTA testing.<sup>20(p13)</sup>

Requiring that PWTA testing be completed during a real estate closing may also have the benefit of reaching families with young children who may be more likely to be purchasing homes. The data gathered as a result of the PWTA has also provided a statewide picture of groundwater quality that has raised awareness about ground water quality in New Jersey. The identification of hotspots for contaminants like arsenic has built community capacity and fostered strategic partnerships between state agencies, local schools, environmental commissions and

healthcare providers. These community partners have conducted targeted outreach through education campaigns and free testing initiatives that have benefited families with children in some of the communities most affected by groundwater contaminants in private wells in New Jersey.



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# Case Study Brief: New Hampshire & Vermont Private Well Testing Via Primary Care Clinics



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# INTRODUCTION

This case study describes an intervention conducted by Dartmouth's Children's Environmental Health and Disease Prevention Research Center in New Hampshire and Vermont from 2016–2018 to provide home well water test kits to families with infants through primary care clinics. The research team was interested in understanding parents' receptiveness to receiving information about private well testing at their child's pediatric practice. The study design was based on previous efforts to improve fluoridated drinking water assessments and blood lead level screening in pediatric healthcare settings.<sup>1</sup> Researchers hypothesized that more parents might complete a well water test at home if they received information from

their child's pediatrician, compared to if outreach materials were received in the mail or from a public health system. The researchers were also interested in testing the best follow-up methods to remind parents to complete their water test kit and to provide families with test results. The intervention found that families were most likely to test their home well water when test kits were provided to parents by a clinician and when the clinic conducted structured follow-up with families. The lessons learned from the program can be used to inform healthcare systems and government agencies that may undertake private well testing or other drinking water interventions through pediatric and primary care health clinics.

*This case study is part of a series of six descriptive case studies of state and local safe home water access policies and programs. The research team collected and reviewed available background materials for each case and conducted semi-structured interviews with key informants about relevant community context and policies, program design, program implementation, and lessons learned. All six case studies and a summary report are available at: <https://www.hsph.harvard.edu/prc/projects/safe-home-water>*

*The research team also developed and compared estimates of the population reach and costs for widespread implementation of each case study policy or program based upon the prevalence of families with children 0–5 experiencing low income with concerns about tap water and/or lack of access to safe home tap water.*



## INTERVENTION RATIONALE

Private wells are unregulated by the federal government and contamination of private wells is common.<sup>2</sup> A significant percentage of people living in New Hampshire and Vermont rely on private wells where arsenic and other contaminants occur in groundwater. A Dartmouth College study that followed New Hampshire mothers and their infants over time found that 10–20 percent of pregnant people with a home well had an arsenic level above

the federal maximum contaminant limit (MCL) for arsenic of 10 parts per billion (ppb),<sup>3</sup> and that even low levels of arsenic exposure can have adverse child health effects.<sup>4(p1)</sup> Other contaminants of concern in private wells include radionuclides, bacteria, nitrates, and poly- and perfluoroalkyl substances (PFAS). Despite this, there is no current standard protocol at pediatric clinics to screen families for home drinking water safety.<sup>1</sup>



## COMMUNITY PARTNERS

The Dartmouth's Children's Environmental Health and Disease Prevention Research Center (Children's Center) partnered with the Dartmouth CO-OP Primary Care Practice-Based Research Network to design the intervention. The Children's Center is a multidisciplinary effort in collaboration with Stanford University, Harvard Medical School and the University of Miami.<sup>5</sup> The Center's mission is to identify and address key emerging issues related to the health impacts of environmental exposures in early life. The Center currently focuses on childhood immune dysfunction, the health impacts of

arsenic on child health, and biomarkers of environmental exposures.<sup>5</sup> The Dartmouth CO-OP Primary Care Practice-Based Research Network includes primary care clinicians, other healthcare professionals, and patient and family representatives from communities in Vermont, New Hampshire, and Maine.<sup>6</sup> The Network is located at the Department of Community & Family Medicine at the Dartmouth Geisel School of Medicine and works to answer community-based healthcare questions and translate research findings into practice.<sup>6</sup>

## INTERVENTION FINANCING

The research study was financed by grants to the Children’s Center from the US Environmental Protection Agency, the National Institute for Environmental Health Sciences, the National Center for Advancing Translational Sciences, and the National Institutes of Health.<sup>1</sup>



## KEY INTERVENTION ELEMENTS

The overall goal of the intervention was to better determine which methods of providing water test kits and conducting follow-up were most likely to result in home well water testing by families with infants. The study ran from 2016 to 2018, and its key elements were to:

1. Educate clinic staff and implement patient screening protocols;
2. Provide test kits to eligible families and provide follow-up reminders if relevant;
3. Receive test results from laboratories and report them to families and/or clinics.

Eleven clinics in geographic areas of New Hampshire and Vermont with a high likelihood of naturally-occurring arsenic in groundwater and high prevalence of private well use participated in the study.<sup>1</sup> Participating clinics received educational materials and training about water

contaminants and how to talk to patients about private wells and water quality, free water test kits, and instructions on how to conduct follow-up with families.<sup>1</sup> A one-hour training was conducted on-site at each clinic for physicians, nurse practitioners, physician assistants, nurses and administrative staff, and participation ranged from 8-20 staff per clinic.

The water test kits provided to the clinics included a prepaid FedEx mailing envelope so that families could mail water samples back through FedEx drop boxes. To protect participant privacy, the water test kits provided to families were anonymized with an assigned random number. The laboratory reported results for each numbered sample to the research team and the research team then matched the numbered test results with participants and provided the results back to participants.



Researchers compared the impact of different methods of follow-up on water test completion and on the communication of test results. Participating clinics were assigned one of four follow-up approaches: 1) no additional follow-up conducted by the clinic; 2) clinician encouraged testing if testing was not completed by subsequent visit; 3) clinic provided with test

results and clinician determined follow-up if water test results were positive for contaminants; and 4) clinic provided with test results and a designated clinic staff member contacted the family to follow-up if testing was not completed or if water test results were positive for contamination.<sup>1</sup>

## STRATEGIES USED TO REACH PREGNANT PEOPLE AND FAMILIES WITH YOUNG CHILDREN

This study was specifically designed for households with an infant up to one year of age (Table 1). Families with infants were chosen as the focus of the study because these families make frequent visits to their pediatricians, creating more opportunities for distributing free water test kits and conducting follow-up. The study team produced posters and

other educational materials for use in clinic waiting rooms and exam rooms to encourage participation by eligible families. They trained clinic staff to discuss water quality with potential participants. De-identified, free test kits were provided to reduce the cost of water quality testing for families, while protecting the privacy of families with private wells.

**Table 1: Intervention Design Elements to Meet the Needs of Families with Infants**

Potential Barrier to Participation	Program Design Element
Ensuring Participants Can Access Water Test Kits and Return Water Samples	Test kits were provided at no cost to participants in pre-paid FedEx overnight return packaging. The use of FedEx enabled the return of water samples within 48 hours to the water analysis laboratory, but FedEx drop boxes may have been inaccessible to some participants.
Addressing Families' Fears That Their Water May Be Contaminated	Information was provided ahead of sampling and testing about what an exceedance means to increase participant confidence.
Protecting Participant Privacy	The study used de-identified test kits to protect participant privacy.
Ensuring that Water Sampling and Test Result Information is Easy to Understand	The research team developed user-friendly test kit instruction forms and water test result reporting forms for use with study participants.

## INTERVENTION RESULTS AND FINDINGS

This section summarizes how many water test kits were completed during the intervention, the water quality results of samples submitted for testing, and ongoing work to provide private well water testing in collaboration with pediatric preventive care clinics.

### Water Test Kit Utilization

The 11 clinics participating in the study distributed 240 testing kits, and 70 tests were returned for an average return rate of 29 percent (Table 2).<sup>1</sup> Across the participating clinics, the percentage of distributed tests kits returned ranged from 17 percent to 45 percent, depending upon who distributed the test kit and the level of follow-up provided.<sup>1</sup> The return rate was higher when the clinician as opposed to other clinic staff distributed the kits, and parents were more likely to return a water sample for testing when clinic staff conducted follow-up with parents to encourage them to return a water sample.<sup>1</sup> The characteristics of the families that chose to have their well water tested are unknown. Clinics did not collect demographic information such as race, primary language spoken, income or Medicaid/Children’s Health Insurance Program enrollment.

### Water Quality Results

Twenty (28 percent) of the 70 test kits returned for analysis had at least one abnormal test result.<sup>1</sup> Ten samples (14 percent) tested positive for arsenic above the EPA’s MCL for arsenic of 10 ppb, and ten samples (14 percent) tested

positive for coliforms with one of the ten samples testing positive for E. coli bacteria.<sup>1</sup> This information was communicated to patients in writing along with their table of test results. Some patients also received verbal follow-up from their clinician. Patients with an exceedance were referred to state agencies for more information on potential mitigation strategies. The research team notified local and state public health agencies in New Hampshire and Vermont of the study in case participants contacted them.

**Table 2: Intervention Results<sup>1</sup>**

240 test kits distributed

70 kits completed

20 completed kits had abnormal test results

Highest completion rate of test kits (45 percent) was from the clinic with a designated clinic staff member to follow up if testing was not completed

Average completion rate of test kits was 29 percent

## Building Community Capacity

After the study concluded, the NH State Public Health Laboratory provided water test kits to the Children's Center to distribute to primary care clinics in New Hampshire and Vermont. Clinics could make the test kits available to families at a cost of \$15 for an arsenic-only test kit and \$85 for a more comprehensive test kit.<sup>1</sup> For well water test ordering, the NH State Public Health Laboratory adopted the user-friendly forms generated by the intervention team during the study. The study authors are currently seeking funding to implement a more permanent iteration of this program in New England, and also hoping to make changes to the electronic health record to prompt clinicians to routinely screen for and record a patient's drinking water source.



### Why Arsenic is Bad

- In children, it can affect growth and brain development.
- For pregnant women, it may cause low birth weight and affect brain development in babies.
- People who drink water with too much arsenic for many years are more likely to get cancer.

One in every 5- 10 wells in our region has unhealthy levels of Arsenic



### Is Your Well Water "HEALTHY" For You & Your Children?

Protect Your Family Testing Information Inside

[www.DartmouthCoopProject.org](http://www.DartmouthCoopProject.org)

### Has Your Well Been Tested?

Did this testing include arsenic, a common natural contaminant in our groundwater?

If you cannot answer YES, to both of these questions, then your well should be tested.

**Contact Us Today!**  
Ph: 603.653.3440

Information Provided by the Children's Environmental Health and Disease Prevention Research Center at Dartmouth with support from NIEHS: P01 ES022832 / U.S. EPA: FD83544201

Program brochure courtesy of Dartmouth's Children's Environmental Health and Disease Prevention Research Center

### How to Test Your Well Water

*Certain minerals or chemicals may be present in your water, depending on the geology and land use in your area.*

1. **Call a certified lab** and ask for a test kit for arsenic. (See below for websites that have certified labs in your state)
2. If you have NEVER tested your well water, you should ask for a kit that includes **arsenic plus bacteria, nitrates, and fluoride**. Other tests may be offered and/or recommended, but depending on your budget, you should consider at least these four. Costs may vary by lab. Arsenic alone is ~ \$10/test. Your health department can advise you. (See contact info below.)
3. **Do the test.**
  - Your test kit will arrive in the mail. Follow the directions and mail bottles back to lab.
4. **Get your results.**
  - If you have too much arsenic in your water, or you are not sure you understand your test results, consult the resources below to get expert help.

**Test Your Water Today!**

*It's up to you to make sure that your water is safe to drink.*

**New Hampshire**  
You can call for a list of certified labs or see the website below.  
NHDES Drinking Water & Groundwater Bureau  
(603) 271-2513  
(603) 271-5171 (fax)  
[http://des.nh.gov/organization/divisions/water/dwgb/well\\_testing/index.htm](http://des.nh.gov/organization/divisions/water/dwgb/well_testing/index.htm)

**Vermont**  
You can order test kits from the Health Department Laboratory at:  
(800) 660-9997 toll free in VT or  
(802) 863-7335 or use another certified drinking water lab available on website:  
[http://healthvermont.gov/enviro/ph\\_lab/water\\_test.aspx#private](http://healthvermont.gov/enviro/ph_lab/water_test.aspx#private)

Program brochure courtesy of Dartmouth's Children's Environmental Health and Disease Prevention Research Center

## IMPLICATIONS

Healthcare clinics and pediatricians are potentially important partners for water quality interventions. They have access to expectant families and families with infants and young children; regularly conduct screenings of patients; and are a respected source of information for families about topics that impact health like home water quality. The clinics that participated in this intervention successfully implemented a screening protocol to identify families with a private well. The project team's partnership with the Dartmouth CO-OP Primary Care Research Network and their work to educate clinics about how private well water contamination can influence child health may have motivated clinics to participate in the intervention. The intervention also demonstrates the importance of conducting follow-up with families about water testing when their children are an age when they are most susceptible to water contaminants like arsenic.



*Program poster courtesy of Dartmouth's Children's Environmental Health and Disease Prevention Research Center*

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# Case Study Brief: The NH Water Well-Ness Initiative to Protect Pregnant WIC Participants from Contaminants in Private Well Water



**HARVARD**  
**T.H. CHAN**  
**SCHOOL OF PUBLIC HEALTH**

Prevention Research Center  
on Nutrition and Physical Activity





# INTRODUCTION

In September 2020, the New Hampshire Department of Environmental Services (NH Dept. of Environmental Services) and the New Hampshire Department of Health and Human Services (NH Dept. of Health and Human Services) began the NH Water Well-Ness Initiative to protect pregnant people enrolled in the federal Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) program and their infants from arsenic in private well water. In parts of New Hampshire, arsenic is a naturally occurring contaminant found in groundwater that is particularly harmful to infants and young children. This case study describes the pilot phase of this five-year program. The goal of the pilot was to conduct well water quality testing for arsenic and filter

pitcher distribution in two counties to evaluate the project design before scaling up statewide. The lessons learned from the NH Water Well-Ness Initiative can be used to inform other private well water testing and filter distribution programs, especially programs that focus on families with infants and young children.

*This case study is part of a series of six descriptive case studies of state and local safe home water access policies and programs. The research team collected and reviewed available background materials for each case and conducted semi-structured interviews with key informants about relevant community context and policies, program design, program implementation, and lessons learned. All six case studies and a summary report are available at: <https://www.hsph.harvard.edu/prc/projects/safe-home-water>*

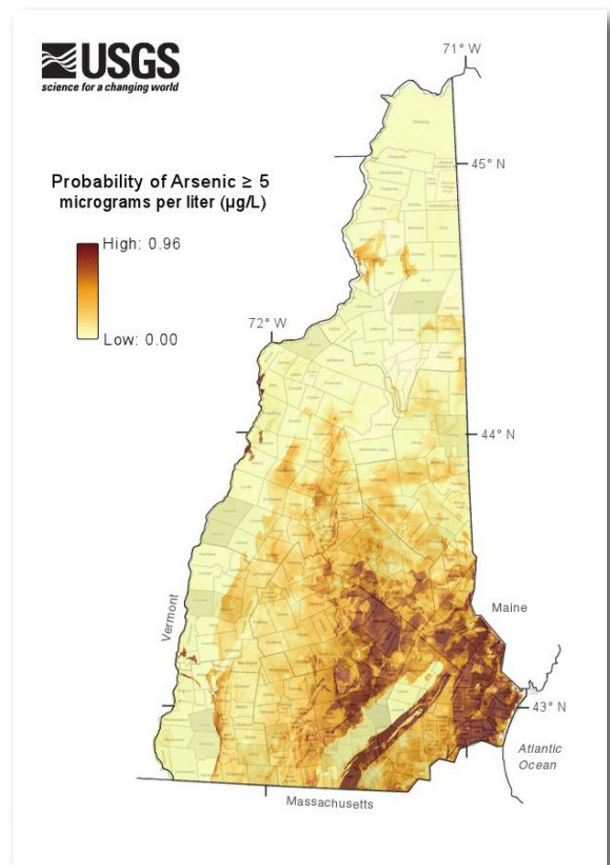
*The research team also developed and compared estimates of the population reach and costs for widespread implementation of each case study policy or program based upon the prevalence of families with children 0–5 experiencing low income with concerns about tap water and/or lack of access to safe home tap water.*

## PROGRAM RATIONALE

The NH Water Well-Ness Initiative seeks to raise awareness about the health risks of arsenic in private well water and to reduce the cost of safe water for pregnant people experiencing low income. Arsenic is a naturally occurring contaminant in New Hampshire groundwater. Effective July 2021, New Hampshire adopted a state maximum contaminant level (MCL) for arsenic in drinking water of 5 parts per billion (ppb) that is more stringent than the federal MCL for arsenic of 10 ppb.<sup>1(p1)</sup> This state policy is enforceable against public water suppliers but not against private wells. New Hampshire only regulates private well water through its building code and a real estate sales disclosure policy.<sup>2</sup>

This regulatory gap for arsenic in private well water and research about the health effects of arsenic motivated the NH Water Well-Ness Program. Almost half (46 percent) of New Hampshire residents rely on private wells for their home water supply.<sup>3</sup> The NH Dept. of Environmental Services estimates that 25 percent of these private wells exceed the state's new 5 ppb MCL for arsenic.<sup>1</sup> A Dartmouth College study of mothers and infants in New Hampshire found that even low levels of arsenic exposure from private well water can have adverse child health effects.<sup>4(p1)</sup> Research also suggests that prior well water testing programs focused on testing alone without offering any support to obtain water filters or bottled water, did not necessarily result in those households taking

action to treat unsafe well water.<sup>5,6,7</sup> These studies informed the program's decision to reduce barriers to safe home drinking water by providing free water testing for arsenic and free water filter pitchers and filter cartridges.



Credit: U.S. Geological Survey, Department of the Interior/USGS; [Scientific Investigations Report 2021-5156](#)



## COMMUNITY PARTNERS

The NH Water Well-Ness Initiative builds New Hampshire's community capacity to address water quality issues through strategic partnerships across the sectors of environmental protection, health, nutrition assistance, and scholarly research. The NH Departments of Environmental Services and Health and Human Services collaborated to develop the program and apply for funding. The NH Dept. of Environmental Services is tasked with protecting the state's groundwater and conducting programs to protect public water systems and private wells.

The NH Dept. of Health and Human Services administers the state Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and has expertise in arsenic-related health outcomes. WIC provides supplemental foods, referrals, and education supports to pregnant people and young children experiencing low income who are at nutritional risk. WIC programs are important community partners for home water quality-focused programs because more than two-thirds (67.6 percent) of the infants participating in WIC are exclusively fed infant formula, most often in a dry, powdered format that is mixed with plain water.<sup>8(p8)</sup>

The NH Dept. of Health and Human Services' Water Analysis Lab tested the water samples collected by program participants. An advisory

committee of representatives of the partners listed above and regional WIC agency directors provides feedback to inform the project's activities. Researchers at Dartmouth College's Children's Environmental Health and Disease Research Center and the Dartmouth Toxic Metals Superfund Research Program also played a key role in raising awareness about the health threat of arsenic in drinking water through regular presentations of their research findings to state agencies and the public.





## PROGRAM FINANCING

The NH Water Well-Ness Initiative accessed new funding from the New Hampshire Drinking Water and Groundwater Trust Fund (hereinafter “Trust Fund”).<sup>9</sup> The Trust Fund was established with money awarded to the State of New Hampshire from an environmental protection lawsuit, and provides grants and loans for water-related projects in New Hampshire.

The Trust Fund initially provided \$333,278 for all program costs.<sup>10</sup> When WIC clinics moved to virtual visits due to COVID-19, the Trust Fund provided an additional \$15,000 to mail water test kits to individual homes.



## KEY PROGRAM ACTIVITIES

The NH Water Well-Ness Initiative began in September 2020 and is anticipated to run for five and half years. The program includes the following activities:

1. Training WIC staff to screen WIC participants for a private well by a private contractor (120Water)
2. Screening of WIC clients for a home well by WIC staff
3. Mailing water sampling kits and written consent forms to eligible households by the private contractor
4. Analyzing water samples for arsenic by a public water analysis lab
5. Sending a filter pitcher and four filter cartridges to those with an arsenic exceedance by the private contractor
6. Conducting outreach and education to program participants by the private contractor

7. Performing follow-up surveys by the private contractor; and
8. Conducting data management to administer and evaluate the program by the private contractor

Training of WIC staff is conducted by the private contractor (120Water) hired by the NH Water Well-Ness Initiative to administer much of the program. Trained WIC staff screen pregnant WIC participants for a private well during the initial WIC visit and inform participants with a private well of their eligibility for free water testing. During the COVID-19 pandemic, these initial screenings are being conducted virtually. As a result, WIC staff obtain verbal consent to enter a participant’s contact information into a program database maintained by the private contractor. The private contractor then mails a water test kit

and a written consent form to the participant's home address. The participant mails back the water sample and consent form in a prepaid envelope to the Water Analysis Lab at the NH Dept. of Health and Human Services Public Health Laboratory. If water testing shows an exceedance of New Hampshire's MCL of 5 ppb for arsenic, the private contractor mails the participant a filter pitcher and four filter cartridges certified to remove arsenic, follows up with educational materials, and conducts

various surveys. These include a survey at the end of the pilot program to inform any modifications to the program design for the full-scale (statewide) program, ongoing follow-up questions to participants about filter use, and an exit survey with participants after they use the four filter cartridges provided by the program. Participants that complete the exit survey receive a voucher in the mail for two additional filter cartridges.

## PROGRAM DESIGN STRATEGIES TO REACH PREGNANT PEOPLE AND FAMILIES WITH YOUNG CHILDREN

The NH Water Well-Ness Initiative was specifically designed for pregnant people enrolled in the WIC program. The New Hampshire WIC Program annually serves between 12,000-14,000 women and young children experiencing low income at nutritional risk and about 25 percent of the state's WIC caseload are pregnant people.<sup>10,11</sup> Table 1 describes how the program was designed to reduce barriers to individual participation in the program.



*Courtesy of USDA WIC Breastfeeding Support*

**Table 1: Program Design Elements to Meet the Needs of WIC Families**

Potential Barrier to Participation	Program Design Element
Ensuring Participants Can Access Water Test Kits, Return Water Samples and Obtain Water Filters	To reduce the overall cost to participants, including their time, of accessing safe water, participants return water samples through the mail in pre-paid packaging, and the program mails the filter pitcher and replacement filters directly to participants' homes.
Addressing Issues Associated with Living in Rental Housing or a Home Owned by Another Person	Many WIC participants live in rental housing or homes where they are not the homeowner. Filter pitchers were selected to avoid the barrier of having to obtain landlord or homeowner approval for water treatment devices that would need to be connected to a plumbing system.
Maintaining Contact with Participants Through Frequent Changes of Address	The program budget assumed that up to 50 percent of pregnant people enrolled in WIC will have at least one change of address during their participation in the program. <sup>10(p12)</sup> To address this, the program follows up with participants to maintain contact with them and offers additional well water testing if a participant moves to a home with a different private well. <sup>10(p9)</sup>
Ensuring that Program Materials About the Risk of Harmful Contaminants in Untested Well Water, Water Sampling Instructions and Test Results Are Easy to Understand	Educational materials were developed to be easy to read and available in English and Spanish. The program also developed an educational video to guide participants through the process of home water sampling.

# PILOT PROGRAM FINDINGS

The pilot program ran through September of 2021 in Rockingham and Hillsborough counties in southern New Hampshire. The pilot program budget estimate provided for up to 50 filter pitchers to be distributed. As of the end of September 2021, WIC offices in the two participating counties had screened 677 pregnant people and 51 (8 percent) reported using a private well (Table 2).<sup>12</sup> Forty-four participants were confirmed to have a private well and received a water sample test kit in the mail, and 18 (41 percent) of those participants mailed in a water sample for testing.<sup>12</sup> A total of 16 water samples were tested by the lab, and 6 filter pitcher kits were distributed to homes where the test results indicated the well water sample exceeded the state MCL for arsenic.<sup>12</sup>

These pilot program findings highlight the difficulty of estimating the number of pregnant WIC participants with a private well. Using statewide averages, the program originally estimated that a little less than half (46 percent) of the 3,800 pregnant people served by WIC clinics in a 24-month period would be on private wells; and about one-third (30 percent) of those would have an arsenic exceedance.<sup>10</sup> The program also did not account for the fact that less than 100 percent of participants would return their water sample and consent form.<sup>10</sup> In practice, just 8 percent of pregnant WIC participants screened during the pilot program were private well users (Table 2). Program staff suspect that the lower rate of private well usage among the pregnant WIC mothers may be due to overrepresentation of WIC clients in multi-unit housing and more densely populated areas that

**Table 2: Summary of Pilot Program Findings<sup>12</sup>**

Program Element	Number Reported
WIC Participants Screened for a Private Well	677
Participants Enrolled in Program	51
Participants Confirmed to Have a Private Well and Mailed a Water Sample Test Kit	44
Water Samples Mailed to Lab	18
Water Samples Tested by Lab	16
Water Samples with an Arsenic Exceedance	6
Filter Pitcher Kits Distributed	6
Filter Replacement Kits Delivered	5

are served by public water systems in the two counties selected for the pilot.

During the course of the pilot, the program found that the analytical methods used to detect arsenic by the water analysis lab also produced reports for four other toxic metals: copper, lead, manganese, and uranium. In order to address exceedances identified for those other four toxic metals, the project team expanded eligibility for filter pitchers from arsenic exceedance only to exceedances of any of the five metals. Due to the lower-than-expected rates of private well use and water samples returned, the program estimates that this can be done within the original program budget. Findings from the pilot program are being used to inform the full-scale program (Table 3).

**Table 3: Program Revisions Following the Pilot Phase of the Water Well–Ness Initiative**

Issue Identified	Program Activity Adopted to Address the Issue
<p><u>Accurately Screening People for a Private Well:</u> WIC participants often did not know whether their water source was from a public water supplier or a private well.</p>	<p>The private contractor will double check that enrollees are not on public water by comparing participant addresses against online maps of water system service areas.</p>
<p><u>Obtaining Consent:</u> participants did not always return the written consent form with their water sample which meant those samples could not be tested without additional follow-up.</p>	<p>WIC staff will use text messaging to follow up with participants regarding returning samples and consent forms. Revised educational materials provided to participants will also address the importance of including a signed consent form with a water sample.</p>
<p><u>Rate of Water Samples Returned for Testing:</u> less than half (41 percent) of pilot program recipients returned a water sample for testing.</p>	<p>The private contractor will follow up with people who received a test kit and a consent form but did not send either back. WIC staff straining will address this, and staff will use text messaging to follow up with participants. Revised educational materials provided to participants will also address this.</p>
<p><u>Addressing Other Toxic Metals Identified During Arsenic Testing:</u> The standard testing protocol for arsenic also yields results for copper, lead, manganese, and uranium.</p>	<p>The full-scale, statewide program will provide filter pitchers and replacement filter cartridges to participants with an exceedance for any of the five toxic metals (arsenic, copper, lead, manganese, and uranium) analyzed during testing.</p>

## PROGRAM IMPLICATIONS

The NH Water Well-Ness Initiative is a notable example of interagency collaboration between state agencies responsible for water quality and human health and nutrition assistance. These kinds of strategic partnerships help to build on existing community capacity to address private well water quality in New Hampshire. Preliminary data indicate a 41 percent return rate of the water test kits distributed by the program. This is higher than some other water testing programs in the Northeast<sup>13,14</sup> and could indicate the importance of using specific program design features to enable and support participation by families with infants and young children experiencing low income. The program findings also highlight the need for better state-level data on the prevalence of home water wells and demographic data about families reliant on home water wells. This data is crucial for accurate program planning, budgeting, and

effective implementation. While this project is focused on serving pregnant WIC participants, key program activities could be expanded for all WIC families with children under the age of 5.



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# Case Study Brief: Porterville, CA

Point-of-Use Filtration & Bottled Water Delivery Pilot Program to Protect Pregnant People and Infants from Nitrates in Private Well Water



**HARVARD**  
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**SCHOOL OF PUBLIC HEALTH**

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# INTRODUCTION

Formula-fed infants and pregnant people are at particular risk from elevated nitrate levels in drinking water.<sup>1,2</sup> This case study describes the Porterville, California, Point-of-Use Filtration & Bottled Water Delivery Pilot Program (hereinafter “Porterville Program”) administered by the non-profit organization Self-Help Enterprises from fall of 2017 to summer of 2019. The Porterville Program partnered with existing local organizations to provide pregnant people and families with young children in unincorporated communities around the City of Porterville, CA with nitrate testing of private well water. Through targeted outreach, the Porterville Program tested the well

water of 117 households for nitrates and, when indicated, provided an interim water supply (home water filtration system or bottled water delivery) to 34 families with pregnant people, infants or very young children who experience low income.<sup>3(p46)</sup> The Porterville Program demonstrates how strategic partnerships can support direct outreach strategies for pregnant people and families with young children living in water-insecure areas. Lessons learned can be used to inform efforts to reduce barriers to safe home water in communities that have been historically disadvantaged and promote greater health equity.

*This case study is part of a series of six descriptive case studies of state and local safe home water access policies and programs. The research team collected and reviewed available background materials for each case and conducted semi-structured interviews with key informants about relevant community context and policies, program design, program implementation, and lessons learned. All six case studies and a summary report are available at: <https://www.hsph.harvard.edu/prc/projects/safe-home-water>*

*The research team also developed and compared estimates of the population reach and costs for widespread implementation of each case study policy or program based upon the prevalence of families with children 0-5 experiencing low income with concerns about tap water and/or lack of access to safe home tap water.*

## PROGRAM RATIONALE

The City of Porterville is located in Tulare County in the San Joaquin Valley of California. The county has a long history of contamination of drinking water by nitrate from animal waste and agricultural fertilizers that disproportionately impacts Latinx and Black residents living in unincorporated communities near cities like Porterville.<sup>4-6</sup> The legal status of these unincorporated communities in California has resulted in discrimination and social exclusion that perpetuates unequal access to safe drinking water.<sup>7</sup>

The Porterville Program started in 2017 and was designed to raise awareness about the health issue of nitrates in drinking water through targeted outreach to families living in unincorporated communities and to reduce the cost of safe water by providing private well water testing and water filters or bottled water as needed. For example, East Porterville was one of the unincorporated communities served by the Porterville Program. Seventy-one percent of its residents speak a language other than English, and Spanish is the predominant language. In the 2010's, the San Joaquin Valley had an acute water crisis due to a prolonged drought. Despite its close proximity to the Porterville municipal water systems, because East Porterville is an unincorporated community, residents were reliant on private wells and experienced periods of no running water due to dry wells or wells with higher concentrations of nitrate due to low

water volumes. Tulare County began delivering bottled water to drought-affected homes, and, after years of advocacy, between 2016 and 2018 most East Porterville homes were connected to the Porterville municipal water system.<sup>8</sup> Water-insecure families living in other unincorporated communities continue to rely on private wells and bottled water delivery from Tulare County.<sup>9</sup>



## COMMUNITY PARTNERS

The Porterville Program arose through a strategic partnership between Self-Help Enterprises (SHE) and the Porterville office of the Special Supplemental Nutrition Program for Women, Infants, and Children (hereinafter “Porterville WIC”). SHE is a non-profit organization focused on affordable housing, rural development, and safe drinking water at schools.<sup>10</sup> The WIC program provides supplemental foods, referrals and education supports to pregnant people and young children experiencing low income who are at nutritional risk.<sup>11</sup> Almost two-thirds (67.6 percent) of the infants participating in WIC are exclusively fed infant formula, most often in a dry, powdered format that must be mixed with plain water.<sup>12(p8)</sup> The Porterville WIC office is part of the Tulare County Public Health Department and serves more than 6,000 clients. Porterville WIC was an ideal community partner because of its existing capacity to reach the families most vulnerable to health harms due to nitrate-contaminated drinking water. SHE also partnered with other Porterville area organizations to assist with community outreach and water sample analysis.

### Porterville Program Community Partners:

- Porterville WIC Office
- Family Healthcare Network
- Community Services Employment & Training (CSET)
- Porterville Area Coordinating Council (PACC)
- City of Porterville Public Works Department's Laboratory





## PROGRAM FINANCING

The Central Valley Salinity Coalition for Long-Term Sustainability (CVSC) is a nonprofit coalition of public agencies, business associations, and other members with a public interest in managing the concentration of dissolved salts

like nitrate in Central Valley water. CVSC provided SHE with \$236,895 to implement the Porterville Program.<sup>3</sup>



## KEY PROGRAM ACTIVITIES

The Porterville Program included several key elements:

- Formalized commitments between SHE and its community partners
- Training for WIC and other community partner staff by SHE
- Focused outreach efforts to identify eligible participants by SHE and community partners
- Collection of water samples and test samples for nitrate by program participants and SHE
- Communication of water testing results to participants by SHE
- Installation of home water filtration systems or bottled water delivery by private companies, and
- Follow-up testing for nitrate in drinking water at homes where filtration systems were installed by SHE

SHE entered into formal memoranda of understanding with the Porterville WIC office and the other community partners that assisted with outreach and referrals. SHE developed educational materials for its own staff and its community partners about the dangers of nitrates in water to pregnant people and young children; program prompts; an intake questionnaire to identify families with private well water; and a consent form. All program materials distributed were available in Spanish and English. SHE conducted trainings with community partners about the program and how to screen families for a private well and how to refer them to SHE for water quality testing assistance. SHE also used mass media (press releases and local media) and community events to conduct additional outreach.

Once SHE staff obtained the contact information of eligible participants and their consent forms from community partners, they coordinated the water quality testing and then followed up with families to explain their test results. Households with a test documenting an elevated nitrate level

were provided with a point-of-use (POU) water filtration system or bottled water delivery by a private company (Culligan) and follow-up water quality monitoring by SHE.

## PROGRAM DESIGN STRATEGIES TO REACH PREGNANT PEOPLE AND FAMILIES WITH YOUNG CHILDREN

The community context and barriers to participation are key factors when designing public health programs.<sup>13(pp10-13)</sup> To be eligible for the Porterville Program, participants had to live in a home reliant on a private well for drinking water in the Porterville area and be a current WIC participant. The program’s initial

design, described in Table 1, addressed barriers to participation in the program. A strength of the program was its ability to adapt during implementation to better serve participants. These program adjustments are discussed in the Program Results and Findings section below.

**Table 1: Initial Program Design Elements to Meet the Needs of WIC Families**

Potential Barrier to Participation	Program Design Element
Ensuring Participants Can Access Water Test Kits, Return Water Samples and Obtain Water Filters	Participants were initially given water test kits and asked to return them within 48 hours. This was not feasible for some families due to transportation challenges.
Addressing Issues Associated with Living in Rental Housing or a Home Owned by Another Person	Both water filtration systems and bottled water delivery were offered to avoid the barrier of having to obtain landlord or homeowner approval for water treatment devices that would need to be connected to a plumbing system.
Maintaining Contact with Participants Identified by the Initial Screening	SHE followed-up by telephone with families that expressed interest in the program.
Ensuring that Water Sampling and Test Result Information Is Easy to Understand	In addition to written notification of test results, SHE followed up by telephone with families with elevated nitrate levels to explain their test results and to offer an interim drinking water supply.

# PROGRAM RESULTS AND FINDINGS

This section summarizes participation in the Porterville Program (Table 2) and adjustments the program made to improve participation.

## Identifying Households Eligible for the Program

As the result of SHE’s outreach efforts through its community partners and the mass media, SHE identified 190 eligible households interested in the program.<sup>3(p44)</sup> The most effective partnership for identifying eligible households was via the Porterville WIC office. General mass media outreach was too broad and generated interest from households in communities not eligible for the program.<sup>3(p50)</sup>

## Water Sampling & Testing

Well water sampling and testing was completed for 117 households.<sup>3(p44)</sup> When the program began, families were responsible for collecting home water samples and returning samples to the Porterville WIC office within 48 hours. Samples were then taken by courier to a private lab in Fresno, CA. During this phase of the program, 59 water samples were collected and 21 (35 percent) demonstrated a nitrate exceedance.<sup>3(p22)</sup> A lack of transportation options experienced by many WIC families was identified by SHE as a barrier to participation. The Porterville Program subsequently shifted course. SHE staff verified eligibility for program participation, and SHE

**Table 2: Program Participants**

Eligible households identified during outreach efforts, that expressed interest in participating in the program	190
Households that had a well water sample tested	117
Households found to have elevated nitrate levels	49
Households provided with bottled water	19
Households provided with a POU system and water quality monitoring	15
Households that discontinued participation in the program before receiving an interim water supply	15

staff visited homes to take water samples, and transported the samples to the local, City of Porterville Public Works Department Laboratory for nitrate testing.<sup>3(pp7, 9, 14, 25, 26)</sup> During the home water sampling phase of the program, 58 samples were collected and 28 (48 percent) demonstrated a nitrate exceedance.<sup>3(p45)</sup> The home water sampling phase of the program improved communication with participants and SHE’s ability to educate participants about private well water quality.

## Bottled Water Delivery

Bottled water was delivered by a private company directly to 19 homes with an elevated nitrate level in their well water.<sup>3(p46)</sup> Families could receive up to 50 gallons per week, or more upon request. The weight of 5-gallon carboys of water posed an accessibility challenge for some families. For future programs, SHE suggests delivery of one-gallon jugs rather than 5-gallon carboys.

## POU Devices & Monitoring

Fifteen households had a reverse osmosis POU device installed under the kitchen sink by a private company (Culligan).<sup>3(p46)</sup> These households received educational materials about how to maintain their POU device. SHE also conducted water quality monitoring (83 total samples taken) to ensure that the POU devices were effectively removing nitrate.<sup>3(p47)</sup> Nitrate removal rates ranged from 55–94 percent.<sup>3(p47)</sup> POU devices installed in homes with very low water pressure did not effectively remove nitrate. When low water pressure was initially identified as an issue, SHE worked with a private company (Culligan) to install booster pumps to increase water pressure.<sup>3(p47)</sup> The program activities were then adapted to take a water pressure reading during the initial water sampling.<sup>3(p40)</sup>

The program also found that the filtration rate of the reverse osmosis POU systems provided to households could not keep up with the water volume needs of larger families.<sup>3(p42)</sup> Bottled water was provided to homes where POU systems were ineffective at bringing down



high nitrate levels or where additional water volumes were needed due to family size. For future programs, SHE suggests providing large families with a larger water storage tank and/or bottled water in addition to the POU filtration device.<sup>3(p42)</sup>



## PROGRAM IMPLICATIONS

A key element of the Porterville Program was forming strategic partnerships with existing entities like the Porterville WIC office to conduct outreach directly to pregnant people and families with young children. The Porterville WIC office was the single largest source of interest for the program. Through its community partnerships, SHE successfully identified 49 families meeting the program's eligibility criteria that had a nitrate exceedance and provided bottled water delivery or a POU system to 34 of those families.<sup>3(pp22, 47)</sup> These were families with infants and young children at high risk from nitrate-contaminated drinking water who were not effectively treating their well water and were not being served by other programs in the county such as the Tulare County bottled water delivery program. The program findings also demonstrate that to reduce the true cost of safe drinking water for families with low incomes,

in addition to the cost of water testing, bottled water delivery, and effective filtration devices programs must factor in costs associated with communication, transportation, family size, and accessibility.



### SUGGESTED CITATION

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# Case Study Brief: Cincinnati Enhanced Lead Program to Replace Lead Service Lines



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# INTRODUCTION

In 2016 and 2017, the Cincinnati City Council enacted ordinances to replace an estimated 39,000 privately-owned lead service lines (LSLs)<sup>1</sup> in the City's water delivery infrastructure over a 15-year period. Greater Cincinnati Water Works (GCWW), the local water utility, began its Enhanced Lead Program in 2016 to carry out the ordinances. Service lines are the pipes that bring water from a water main in a public street to private homes. Cincinnati's approach to phasing out all LSLs has begun by including private LSL replacement as part of routine water main replacement work. This case study will focus on the elements of the Enhanced Lead Program that apply to residences (as opposed to businesses, schools or childcare centers). To reduce the cost of private LSL replacement, the water utility began by providing subsidies and interest-free

financing to property owners, and additional subsidies for property owners with low incomes, and it now pays 100 percent of the cost of private LSL replacement. Policies and programs to address LSLs are an important strategy to improve the built environment. In general, homes with a LSL are more likely to report higher water lead levels at the tap and LSLs are estimated to contribute between half and three-quarters of the total mass of lead in drinking water.<sup>2</sup> Households with pregnant women and children under six years old are most at risk for adverse health and developmental outcomes from exposure to lead in drinking water.<sup>3</sup> The lessons learned from GCWW's Enhanced Lead Program may inform the actions of other water utilities and state and local elected officials that undertake similar programs.

*This case study is part of a series of six descriptive case studies of state and local safe home water access policies and programs. The research team collected and reviewed available background materials for each case and conducted semi-structured interviews with key informants about relevant community context and policies, program design, program implementation, and lessons learned. All six case studies and a summary report are available at: <https://www.hsph.harvard.edu/prc/projects/safe-home-water>*

*The research team also developed and compared estimates of the population reach and costs for widespread implementation of each case study policy or program based upon the prevalence of families with children 0-5 experiencing low income with concerns about tap water and/or lack of access to safe home tap water.*

## POLICY RATIONALE

The Cincinnati City Council crafted its local ordinances to achieve full LSL replacement “to the extent practically possible.”<sup>4</sup> Lead service lines are jointly owned by public utilities and private homeowners. Evidence shows that replacing the entire LSL is the most effective way to reduce exposure to lead at the tap.<sup>2</sup> Replacing both sides of a LSL can be challenging because the utility or a private contractor needs consent to enter private property to make the replacement, and, typically, private property owners have been responsible for the cost of private LSL replacement.<sup>2</sup>

## COMMUNITY PARTNERS

Greater Cincinnati Water Works is a public water utility serving the City of Cincinnati and surrounding areas. Utility leadership were interested in doing more to accelerate full LSL replacement, and advocated for municipal policy changes in Cincinnati to authorize a new program that would phase out all LSLs.





## PROGRAM FINANCING

The cost of the Enhanced Lead Program was originally estimated at \$145.5 million (\$9.7 million per year over 15 years).<sup>5</sup> An economic analysis conducted by the City found that GCWW could fully fund the program through new revenue from annual rate increases of 3.75 percent, refinancing existing debt, and issuing new debt at favorable rates.<sup>5,6</sup> GCWW initially funded the Enhanced Lead Program primarily through existing funding from its capital improvement program funds. For example, in 2021 the City appropriated \$4.2 million from the City's Water Works Fund 101 for private LSL replacement.<sup>7(p15)</sup>

In 2020, the City appropriated one-third of future lease revenue from a cellular telephone company (\$3,325) for the Help Eliminate Lead Pipes (HELP) program to provide subsidies to families with low incomes.<sup>8</sup> Beginning in 2022, GCWW has been authorized to provide 100 percent subsidies for private LSL replacement to property owners regardless of income.<sup>9</sup> Replacements will be primarily financed through a water rate increase.<sup>10</sup>



## KEY POLICY ELEMENTS AND PROGRAM ACTIVITIES

The Cincinnati City Council directed GCWW to undertake an inventory of LSLs,<sup>5,11</sup> and passed a trio of local ordinances that:

1. Established the Enhanced Lead Program;<sup>12</sup>
2. Prohibited existing LSLs by authorizing GCWW to serve property owners with a notice ordering the removal and replacement of a LSL within a certain period of time;<sup>12</sup>
3. Required landlords to inform tenants of the presence of a LSL prior to executing a lease agreement;<sup>12</sup>
4. Provided subsidies and established a property tax assessment program to provide financing to homeowners for private LSL replacements;<sup>13</sup>
5. Established the Help Eliminate Lead Pipes (HELP) program to provide additional subsidies to low-income residents for LSL removal and replacement.<sup>14</sup>

GCWW's Enhanced Lead Program coordinates and conducts partial or full LSL replacement and provides post-construction notices and water filter kits for use immediately after LSL replacement.

The ordinance prohibiting LSLs phases in removal by providing a grace period for removal until a property owner is provided with written notice from GCWW of the need for replacement. GCWW originally provided a subsidy for 40 percent of the cost (up to \$1,500) of private LSL

replacement.<sup>15</sup> GCWW customers could pay right away or through a 5 or 10-year interest-free property tax assessment. GCWW also administered the HELP program to provide additional subsidies for LSL replacement to property owners with a household income that was 80 percent of HUD-defined Area Median Income (e.g. \$68,300 or less for a family of four).<sup>16</sup> Beginning in 2022, GCWW will provide 100 percent subsidies for private LSL replacement to property owners regardless of income, and aims to replace 1,200 private LSL annually.<sup>9,10</sup>

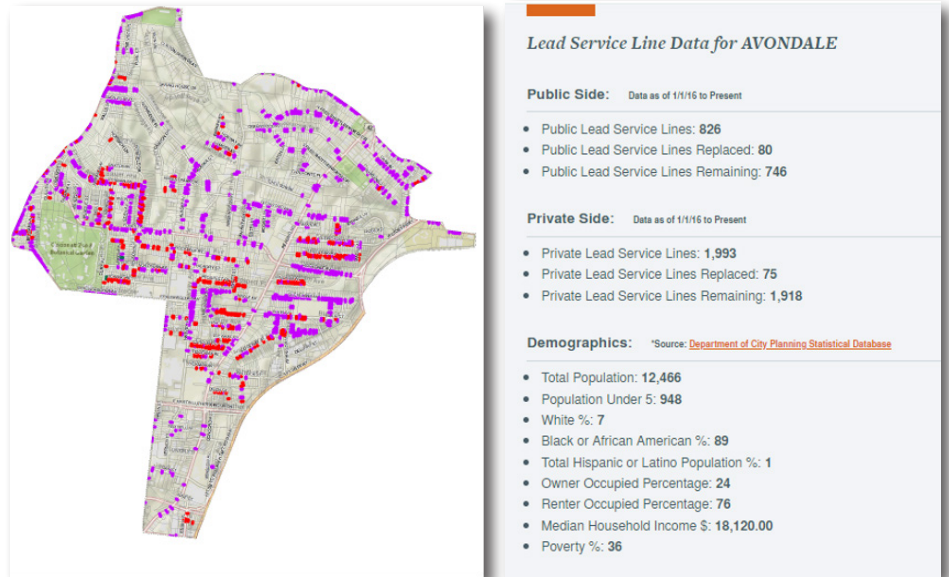
## STRATEGIES USED TO REACH FAMILIES WITH CHILDREN 0-5 WHO EXPERIENCE LOW INCOME

By local ordinance, GCWW has the discretion to prioritize replacement of LSLs "based on public health risk and economic considerations."<sup>17</sup> In 2017, GCWW stated that it would consider the following factors when determining where to conduct LSL replacement: the presence of children six years and under; state health department data about high blood lead levels in children; water infrastructure projects with more than 100 public LSLs in need of removal; timing LSL removal to coincide with road improvement projects; the presence of properties with water test results above the action level for lead; and other criteria "as indicated and related to children exposed to lead."<sup>18</sup>



More recently, utility leadership have stated that work will be prioritized for neighborhoods with a high density of remaining LSLs.<sup>19</sup> GCWW is in the process of providing on its website neighborhood profiles with demographic data and data about existing LSLs and public and private LSL replacements (Figure 1).<sup>20</sup>

**Figure 1: Enhanced Lead Program Neighborhood Profiles**



Courtesy of Greater Cincinnati Water Works' "See Progress in Your Neighborhood"; <https://la.mygcww.org/neighborhoods>

## CURRENT POLICY IMPLEMENTATION APPROACH

The ordinances enacted by the Cincinnati City Council provided for a variety of paths forward to address LSLs in the City. Table 1 summarizes the policy implementation approaches taken by GCWW.

### LSL Replacements

The 15-year Enhanced Lead Program began in 2016, and the first LSL replacements conducted under the program were in 2018.<sup>19</sup> GCWW

estimated that there were approximately 39,000 private lead service lines within the City of Cincinnati when the program began. According to GCWW, between February 2018 and April 2021 a total of 1,164 private LSL replacements have been completed as part of the Enhanced Lead Program.<sup>21(p15)</sup>



There were 716 completed with funding from a 5 or 10-year zero interest property tax assessment and 448 were paid for in full by the property owner.<sup>21(p15)</sup> GCWW has been replacing private LSLs during routine water main replacements, at the request of a property owner, or when there is a leak in a service line.<sup>21(p15)</sup> If a water main is connected to a private LSL, GCWW “strongly advises” that the private LSL be replaced.<sup>15</sup> The utility is authorized by a local ordinance prohibiting LSLs to compel private side replacement by serving a notice to the homeowner ordering private LSL replacement. Under the more voluntary implementation approach of “strongly” advising private LSL replacement, full LSL replacements, meaning both the public and private sides of a LSL are replaced, occurred about 30-40 percent of the time on water main projects with high concentrations of LSLs.

### Cost of LSL Replacements

According to GCWW, the costs of private LSL replacement had been declining until supply chain disruptions and inflation in late 2021 impacted costs. In fiscal year 2020 the average total cost of private LSL replacement to the property owner before receiving any subsidies from GCWW or the HELP program was \$3,247, and in 2021 the average cost was reduced to \$2,400.<sup>22, 21(p15)</sup> In 2021, for property owners receiving the standard 40 percent subsidy from GCWW, the average cost of LSL replacement after receiving the subsidy was \$1,440.<sup>21(p15)</sup> Beginning in 2022, the utility will provide a 100 percent subsidy for all private LSL replacements, and the utility estimates that the average cost will be approximately \$3,000.

### HELP Program

According to GCWW, as of January 2022, the HELP program to assist families with low incomes with the cost of LSL replacement had provided \$376,150 in subsidies benefiting over 178 eligible homeowners.<sup>20(p15)</sup> Prior to 2021, the HELP program provided a subsidy of 30 percent of the cost of private LSL replacement in addition to the 40 percent subsidy available to all property owners. In 2022, all property owners, regardless of income, with a private LSL can receive a 100 percent subsidy.<sup>9</sup>

### Tenant Notification

Since July of 2017, landlords in the City of Cincinnati have been required to notify tenants in writing and before executing a lease if a rental unit receives its water through a LSL.<sup>12</sup> While this notification is required, the ordinance establishing the requirement does not contain any enforcement mechanisms or reporting requirements. As a result, it is not known to what extent prospective tenants are being notified of LSLs.



**Table 1: Policy Implementation Approaches  
for Private LSL Removal Taken by the Enhanced Lead Program**

Policy Elements for Private LSLs	Implementation Approaches Used
Remove and replace all private LSLs by 2033 (~6.6 percent per year)*	<ul style="list-style-type: none"> <li>• 1 percent per year on average (2018–2020)**</li> <li>• 3 percent per year on average projected (2022–until completion)</li> </ul>
Private LSLs can be replaced by GCWW: during water main replacement, as targeted neighborhood replacements without water main replacement, or as individual LSL replacements <sup>23</sup>	<ul style="list-style-type: none"> <li>• Property owners are provided with the option to replace private LSL during water main replacement<sup>15</sup></li> <li>• LSLs are replaced at the request of an individual property owner<sup>21</sup></li> <li>• LSLs are replaced when there is a leak in a private LSL<sup>21</sup></li> </ul>
Existing LSLs are prohibited. Prior to enforcement, property owner must be served with at least thirty days written notice of the need to replace a LSL <sup>24</sup>	<ul style="list-style-type: none"> <li>• Enforcement is being phased in over time</li> <li>• In 2020, 60 – 70 percent of LSL replacements on water main projects were partial LSL replacements where only the public side of the LSL was replaced</li> </ul>
Property owners shall be responsible for the cost of replacement of the portion of the LSL on private property <sup>25</sup>	<ul style="list-style-type: none"> <li>• GCWW provided a subsidy of 40 percent (up to \$1,500) of the cost of private LSL replacement (2018–2021)<sup>15</sup></li> <li>• Beginning in January 2022, GCWW will provide a 100 percent subsidy for a projected 1,200 private LSLs annually<sup>9,10</sup></li> </ul>
Property owners can pay for private LSL replacement in full or through a property tax assessment (no interest rate specified) <sup>26</sup>	<ul style="list-style-type: none"> <li>• From 2018–2021, a zero percent interest special assessment payable over a period of 5 or 10 years was available to property owners that had GCWW coordinate their LSL work</li> </ul>
HELP program fund was established to provide subsidies to property owners with low incomes <sup>14</sup>	<ul style="list-style-type: none"> <li>• From 2018–2021, GCWW provided subsidies of 30 percent of the cost of private LSL replacement in addition to the 40 percent subsidy available to all property owners</li> <li>• Beginning in January 2022, GCWW will provide a 100 percent subsidy, regardless of income<sup>9</sup></li> </ul>

\*39,000 (total private-side LSLs) / 15 (years to replace) = 2,600 private-side LSL replacements per year (6.7 percent per year)

\*\* 1,164 completed private-side LSL replacements over approx. 3 years = an average annual replacement rate of 1 percent ((388/39,000) x 100 = .99)

## POLICY AND PROGRAM IMPLICATIONS

The City of Cincinnati established the Enhanced Lead Program to improve the water supply infrastructure by removing LSLs. The intent of the original ordinances that established the program was to remove all LSLs from the City's water distribution system by 2033. The ordinances establishing the program provide GCWW with the authority needed to complete private LSL removal and funding mechanisms to provide subsidies to property owners. The policy foundation established by the City Council could also facilitate GCWW's transition from "strongly advising" property owners to replace the private side of a LSL during water main replacement to requiring that all private LSLs encountered during water main replacement are removed and replaced. Since the program began replacing private LSLs in 2018, GCWW has increased

financial assistance for property owners, and increased the number of full LSL replacements each year.



### SUGGESTED CITATION

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# Case Study Brief: Denver Water Filter Program



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Prevention Research Center  
on Nutrition and Physical Activity





# INTRODUCTION

This case study describes Denver Water’s Filter Program (hereinafter “Filter Program”) to distribute water filter pitchers to customers with a known or suspected lead service line (LSL) while it works to remove customer-owned LSLs as part of its Lead Reduction Program. Denver Water is the public water utility for Denver, Colorado serving about one quarter of Colorado’s total population (1.5 million customers).<sup>1</sup> Pursuant to a program approved by the US Environmental Protection Agency (EPA), the utility plans to improve the built environment by removing all LSLs from its service area by 2035. The Filter Program was included as part of Denver Water’s LSL removal strategy because LSLs are the primary source of lead in drinking water,<sup>2</sup> and the process of LSL removal can

cause short-term spikes in lead exposure at the tap.<sup>3</sup> Ingestion of lead is of particular concern for pregnant people, formula-fed infants, and young children. Denver Water’s Filter Program utilizes an equity-based prioritization model and strategic partnerships with community organizations to ensure that all eligible families receive water filters at no cost and families most at risk from the health harms of lead in drinking water are prioritized during the 15-year LSL removal process. The lessons learned from Denver Water’s Filter Program can be used to inform the work of other water utilities and state and local agencies working to integrate health equity principles into programs to distribute filter pitchers to address drinking water contaminants of concern.

*This case study is part of a series of six descriptive case studies of state and local safe home water access policies and programs. The research team collected and reviewed available background materials for each case and conducted semi-structured interviews with key informants about relevant community context and policies, program design, program implementation, and lessons learned. All six case studies and a summary report are available at: <https://www.hsph.harvard.edu/prc/projects/safe-home-water>*

*The research team also developed and compared estimates of the population reach and costs for widespread implementation of each case study policy or program based upon the prevalence of families with children 0–5 experiencing low income with concerns about tap water and/or lack of access to safe home tap water.*

## PROGRAM RATIONALE

The Filter Program is part of Denver Water's comprehensive Lead Reduction Program. According to Denver Water, the primary source of lead in drinking water in its service area comes from the estimated 64,000–84,000 customer-owned LSLs (pipes) that bring water from public water mains in the street to home plumbing systems.<sup>4</sup> In 2012, more than 10 percent of the drinking water samples analyzed by Denver Water to comply with the federal Safe Drinking Water Act's Lead and Copper Rule exceeded the federal action level for lead of 15 ppb.<sup>5</sup> The elevated lead levels triggered state and federal legal requirements that the utility study lead remediation options.

In 2018, the Colorado Department of Public Health and the Environment ordered Denver Water to use the additive orthophosphate to inhibit corrosion as water travels through LSLs and home plumbing systems.<sup>5</sup> Environmental organizations and water quality advocates were concerned about the impact of phosphates in wastewater from orthophosphate-treated water on the region's groundwater quality and filed a lawsuit to prevent the use of orthophosphate.<sup>6</sup> Denver Water subsequently applied for special permission from the EPA to avoid orthophosphate treatment by executing a 15-year Lead Reduction Program whereby Denver Water would pay to remove all customer-owned LSLs and supply water filter pitchers to customers with a known or suspected LSL and to certain

households with copper pipe and lead solder. The Lead Reduction Program was found to be less costly and posed a lower risk to groundwater quality than orthophosphate treatment. It received EPA approval in December 2019<sup>5</sup> and Denver launched the Lead Reduction Program in January 2020.



*Courtesy of Denver Water*

## COMMUNITY PARTNERS

The Filter Program builds community capacity to raise awareness about lead in drinking water through strategic partnerships with the Colorado Special Supplemental Nutrition Program for Women, Infants and Children (WIC) and other community organizations. WIC provides supplemental foods, infant formula, referrals, and education supports to pregnant people and young children experiencing low income who are at nutritional risk. Almost two-thirds (67.6 percent) of the infants participating in WIC are exclusively fed infant formula, most often powdered formula that must be reconstituted with plain water.<sup>7(p8)</sup> The collaboration between Denver Water and Colorado WIC primarily consisted of information sharing. Colorado WIC provided geographic data on WIC participation rates to Denver Water to inform a prioritization model for the Lead Reduction Program. Denver Water conducted a training for Colorado WIC program staff to ensure they were incorporating drinking water into lead reduction educational activities. Denver Water also shared data about the LSLs in its service area with WIC.

For its community outreach and education efforts, Denver Water obtained formal commitments (via paid partnerships) with the community organizations iNow and CREA Results.<sup>8</sup> The organization iNOW (integration: Navigation, Outreach, Wealth-Building) focuses on refugee integration through evidence-based pathways like physical health and well-being.<sup>9</sup>

CREA Results is a grassroots organization of Promotores de Salud (Community Health Workers) who are fluent in Spanish and sensitive to the local Latinx culture.<sup>9</sup> When designing and piloting the Filter Program, Denver Water also worked with Groundworks Denver, Mile High Youth Corps, Clean Water Action, and the Greenway Foundation to incorporate community and stakeholder input.







## PROGRAM FINANCING

The total cost of the full scale Filter Program is estimated to be \$33-48 million depending on the number of filters pitchers and replacement filters distributed during the 15-year Lead Reduction Program.<sup>10(p260)</sup> Denver Water plans to

fund the program through a combination of new and existing funding from water rates, bonds, new service fees, hydropower generation, and potentially loans, grants and other contributions.<sup>11</sup>



## KEY PROGRAM ACTIVITIES

The Filter Program is required as part of Denver Water's EPA-approved Lead Reduction Program.<sup>5</sup> The program must deliver filter pitchers and replacement cartridges to all utility customers with known or possible LSLs until six months after a customer's LSL is removed or until the customer's service line is determined to be of another material. Families with a formula-fed infant under 2 years old living in a home built between 1983-87 that does not have a LSL but may have lead solder, are to be provided with free water testing and filter pitchers and replacement filters if water testing indicates elevated levels of lead.<sup>12</sup> Under its EPA-approved plan, Denver Water must achieve a 65 percent filter adoption rate to provide equivalent protection to orthophosphate treatment.<sup>5</sup> If at any time the adoption rate falls below 75 percent, additional actions will be triggered, such as increased or modified communication,

outreach, and education efforts with particular attention to sub-groups.<sup>5</sup>

The Filter Program includes the following program activities:

1. Determination of priority areas to receive filters and educational materials based on LSL inventory data and a prioritization model by Denver Water and private contractors (Mott MacDonald and AECOM);
2. Mailing of filter kits and replacement cartridges to customers by a private contractor (120Water);
3. Surveys of customers to determine filter adoption rate assisted by a private contractor (Mott MacDonald); and
4. Promotion of filter use and awareness of the Filter Program by Denver Water and community partners.

Denver Water contracted with private engineering companies (Mott MacDonald and AECOM) to develop its prioritization model for its comprehensive Lead Reduction Program that includes LSL replacement and filter pitcher distribution.<sup>13</sup> A private company (120Water) is under contract to distribute and track filters and replacement cartridges, provide

educational materials, and provide web-based data management services for the program. Denver Water and its paid community partners (iNOW and CREA Results) promote filter use through community events, social media posts, door-to-door outreach, a customer tracking system, how-to videos, and conducting virtual educational meetings open to the public.<sup>3,14</sup>

## PROGRAM DESIGN STRATEGIES TO REACH PREGNANT PEOPLE AND FAMILIES WITH YOUNG CHILDREN

The Filter Program incorporates health equity and environmental justice principles into its design with a focus on homes most likely to have an LSL and customers most at risk from the health consequences of lead in drinking water. For its filter distribution and community outreach and education activities, Denver Water utilizes a variety of strategies to reach pregnant people and families with young children living in homes with a LSL (Table 1).

Families with a formula-fed infant under two years old living in homes without a LSL built between 1983-87 can participate in the Filter Program if water testing indicates an issue with lead.<sup>12</sup> Denver Water identified about 15,000 properties built between 1983-1987, including many multi-unit structures, and began outreach to these properties in the third quarter of 2020.<sup>16</sup> As of July 2021, Denver Water had sent letters describing the Filter Program to more than 38,000 households and 242 families with formula-fed infants requested a water test kit.<sup>15(p19)</sup> Ten test results showed lead above three

micrograms per liter (a trigger level used to indicate a problem with lead).<sup>15(p19)</sup> Of those ten, two families with a formula-fed infant enrolled in the Filter Program.<sup>15(p19)</sup>



**To make sure lead stays out of your water, we're starting with your pipes.**

Denver Water is committed to delivering safe water to our community. So, we're replacing customers' lead pipes, one impacted property at a time. To find out if you're one of them, visit our website.

Learn more at [DenverWater.org/Lead](https://denverwater.org/Lead)

**DENVER WATER**  
LEAD REDUCTION PROGRAM

*Courtesy of Denver Water*

**Table 1: Program Design Elements to Meet the Needs of Pregnant People and Families with Young Children**

Strategy	Description
Prioritization Model	<p>Denver Water decides how to focus its community outreach and education efforts for the Filter Program using a prioritization model that combines LSL inventory data with socio-demographic data. The socio-economic data used includes an area-based analysis of the distribution of household income, minority status, WIC participation data, child blood lead level monitoring data, and the relative prevalence of expecting families and families with young children in a given area.<sup>15(p63)</sup></p>
Tenant Outreach	<p>Denver Water provides introductory program materials and filter kits to apartment complexes for distribution to new tenants when they move in and conducts phone and email follow-up with customers with non-deliverable, returned filter kits.<sup>15</sup></p> <p>Denver Water also conducts outreach with leasing offices to make them aware of the Filter Program.</p>
Educational Outreach	<p>To increase awareness about the Lead Reduction Program and promote Filter Program participation by families with infants and young children, Denver Water has conducted educational outreach visits at the Rocky Mountain Early Childhood Conference; the City and County of Denver’s Head Start &amp; Office of Children’s Affairs; the Denver Early Childhood Council; the Road to Reading Summit held by Denver Public Schools; and the Children’s Environmental Health Network.<sup>15(p50)</sup></p>



## PROGRAM RESULTS AND FINDINGS

### *Pilot Program*

In summer of 2019, Denver Water conducted a pilot filter program to inform the design of the full-scale Filter Program.<sup>10(p3)</sup> The pilot distributed 300 filter pitcher kits in mixed-income neighborhoods with a mix of English- and Spanish-speaking residents, and higher concentrations of “expecting families, children, and those of low socioeconomic standing.”<sup>10(p3)</sup> Households received a ZeroWater pitcher filter kit and educational materials through the mail (200 households) or door-to-door delivery (100 households) and completed surveys about their filter usage. Surveys indicated that 67 percent of the participants filtered their water for drinking and cooking.<sup>10(p20)</sup> The total cost of the pilot program was \$122,230.<sup>10(p18)</sup>

Lessons learned from the pilot program were incorporated into the full-scale program design. To reduce costs, provide longer-lasting filter cartridges, and to limit fluoride removal from filtered water, Denver Water switched from ZeroWater filter pitchers to Brita filter pitchers and entered into a three-year contract with Brita. The utility also found that distributing filters by mail was more cost-effective than door-to-door delivery, and all filter kits are being provided through the mail for the full-scale program.

### *Full Filter Program*

#### Filter Distribution

In March 2020, Denver Water began its full-scale Filter Program.<sup>16</sup> As of July 2021, Denver Water has distributed filter pitcher kits and replacement cartridges every six months to all customers with a known LSL or a service line of unknown material in its service area.<sup>15(p39)</sup> Denver Water estimates that approximately 97,735 Denver Water households are participating in the Filter Program as of July 2021.<sup>15(p37)</sup> Throughout the filter program, anyone may call to request extra filters based on household size or being an in-home childcare provider. Households that request additional filters are placed onto a list of high demand filtered-water users who then automatically receive additional replacement cartridges during subsequent replacement filter mailings.<sup>17(p12)</sup>

#### Culturally Competent Community Outreach and Education

The Filter Program uses data from its prioritization model and user surveys to identify neighborhoods, households, and communities most likely to have a LSL and most vulnerable to the health harms of lead in drinking water. This information is used to determine where to focus the program’s outreach and education resources. To reach non-English speaking and

culturally diverse households, Denver Water makes all materials available in English and Spanish and contracts with the community organizations iNOW and CREA Results. In neighborhoods prioritized for community outreach and education, iNOW provides information and support in the languages of Amharic, Arabic, French, Nepali and Somali, maintains a virtual helpdesk, distributes educational materials to community organizations and businesses, generates social media posts and online videos, and hand delivers filter pitchers and cartridges to non-English and non-Spanish speaking community members.<sup>15</sup> CREA Results conducts similar outreach and education for Denver’s Spanish-speaking community.

### Filter Adoption Rate

To evaluate the effectiveness of the Filter Program, Denver Water monitors what it calls the “filter adoption rate.” To determine the filter adoption rate, Denver Water periodically surveys homes provided with filters by the Filter Program about whether or not they use filtered water for drinking water, cooking and/or infant formula preparation. A November 2020 survey was sent to 20,000 households, and 3,987 responses were received (20 percent response rate). Of the households that responded to the survey, 93 percent reported using filtered water for drinking and 68 percent reported using filtered water for cooking.<sup>18,19(p19)</sup> The total “calculated filter adoption rate” among these respondents was 80 percent.<sup>19(p19)</sup> Denver Water intends to conduct educational efforts focused on the importance of using filtered water for cooking.<sup>18, 20</sup>

Denver Water also uses its survey data to assess whether filter use varies by income, ethnicity, language spoken at home, tenancy (renter vs. owner-occupied) and whether there is a young child in the home. Among the respondents to the November 2020 survey, there were similar filter adoption rates by income, ethnicity, language spoken at home, tenancy (renter vs. owner-occupied), and presence of a young child in the home.<sup>21</sup>

Of the November 2020 survey respondents, 102 households reported that they had a formula-fed infant, and 97 percent reported using filtered water for formula preparation.<sup>19(p19)</sup> The 102 households with formula-fed infants were sent a reminder card in the mail emphasizing the importance of using filtered water to prepare infant formula.<sup>15(p63), 22</sup>



## PROGRAM IMPLICATIONS

Denver Water’s Filter Program is part of Denver Water’s EPA-approved Lead Reduction Program and must meet specific filter adoption benchmarks or be subject to an enforcement action to begin orthophosphate treatment. Denver Water provides filters and replacement filters at no cost to participants and focuses its community outreach and education efforts using an equity-based prioritization model and user survey data. This approach is grounded in the overall program goals of identifying and serving households most likely to have an LSL and most vulnerable to the health harms of lead in drinking water. User surveys indicate that filter usage is similar across all groups that responded to the survey including households with lower incomes, renters, households with children and Latinx households. Key components of Denver Water’s commitment to ensuring that all households can participate in the Filter Program

have been its paid community partnerships to deliver culturally competent outreach and education, and a tenant outreach strategy focused on providing customers with an LSL with water filters regardless of whether they own or rent their home.



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