APPENDIX I

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# Comparing the Cost of Bottled Water vs In-Home Filter Provision for a Lead Action Level Exceedance

## Technical Memorandum

December 2022

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# 1 Introduction

In the event of a lead action level exceedance (ALE) or a similar water quality event, public water systems (PWSs) can be mandated by United States Environmental Protection Agency (EPA) or their primacy agency to take corrective action by supplying affected customers with a filtration device and/or bottled water. Currently, there are no federal requirements under the Lead and Copper Rule Revisions (LCRR) for systems to provide customers with such provisions following a lead ALE, but some systems have been required to do so through administrative or consent orders. While there are currently systems mandated into such programs, there are no existing guidelines to aid systems with initiating, managing, and terminating a filter or bottled water program. Therefore, the objectives of this memorandum are to:

- Document instances where systems have been required to provide customers with a filter device or bottled water in the event of a lead ALE,
- Summarize program elements, costs, and implementation challenges, and
- Provide a framework for ending this type of program.

# 2 Study Approach

Six (6) systems across the U.S. that have implemented a bottled water or filter program due to the presence of lead in customers' drinking water or blood were identified and asked to participate in a survey providing information on their filter and/or bottled water program. Because only a small number of systems that met these criteria were identified, the survey was extended to utilities that have been voluntarily providing filters for other lead related programs and utilities that have provided bottled water programs for other water quality events. Data are summarized for a total of eleven (11) systems from nine (9) states with varying system sizes and program types, as shown in Table 2-1. Information was retrieved mainly through phone interviews guided by a survey template (refer to Appendix A) as well as electronic responses and /or through publicly available information. It should be noted that not all systems responded to all questions.

*Table 2-1 Summary of Public Water Systems*

| State | PWS | Population Served (approx.) | Basis for Program | Program Type | Eligible Customers |
|---|---|---|---|---|---|
| MI | Benton Harbor | 9,800 | Consent order after a lead ALE | Filters; Bottled Water | All residents |
| NJ | Newark | 294,000 | Consent order after a lead ALE | Filters; Bottled Water | Following a LSLR, LSL disturbance, or high lead level |
| WV | Clarksburg | 65,000 | Consent order following discovery of elevated blood lead levels (BLLs) in children | Filters; Bottled Water | To residents where known LSLs exist until corrosion control treatment has been installed |

| State | PWS | Population Served (approx.) | Basis for Program | Program Type | Eligible Customers |
|---|---|---|---|---|---|
| CO | Denver Water | 1,500,000 | Required as part of variance application after a lead ALE | Pitcher Filter | Following a lead service line replacement (LSLR), or high lead level |
| -- | Utility A | 81,000 | Administrative order following detection of elevated lead levels in drinking water | Filters; Bottled Water | All residents until one year after all LSLs are removed |
| -- | Utility B | 655,000 | Consent order after a lead ALE | Pitcher Filter | Customers that have had a partial lead service line replacement (PLSLR) |
| -- | Utility C | 300,000 | Initially voluntary, then mandated after a lead ALE | Pitcher Filter; Bottled Water | Following a LSLR, LSL disturbance; voluntarily providing to customers with high lead level |
| -- | Utility D | 632,000 | Voluntary | Pitcher Filter | Following a LSLR |
| -- | Utility E | 1,100,000 | Voluntary | Filters | Following a LSLR, LSL disturbance, or high lead level |
| -- | Utility F* | 3,500 | High concentrations of PFAS in finished water | Point of Entry (POE) Filter; Bottled Water | Customers that have high levels of PFAS based on customer sampling |
| -- | Utility G* | N/A | Emergency Event | Bottled Water | Varies depending on event |

* Program(s) unrelated to lead

Outreach was also conducted to six (6) state agencies including ones that have previously required systems to implement a filter or bottled water program due to lead exposure to obtain input on the potential requirements for conducting and terminating a filter or bottled water program specifically due to a lead ALE. Regulators from three (3) state drinking water regulatory programs participated in a phone interview and are summarized in Table 2-2.

*Table 2-2 Participating State Regulators*

| State | State Regulator | No. of PWS[1] | Population Served by All PWSs |
|---|---|---|---|
| MI | Department of Environment, Great Lakes, and Energy (EGLE) | 10,135 | 10,000,000 |
| OH | Ohio Environmental Protection Agency (OEPA) | 4,323 | 11,000,000 |
| WV | Department of Health and Human Resources (DHHR) | 805 | 400,000 |

Key findings from the surveys including costs are summarized herein. Detailed case studies for Benton Harbor and Clarksburg are provided in Appendix B. Material costs were escalated to 2022 dollars using the U.S. Bureau of Labor Statistics Consumer Price Index (CPI) for comparison purposes. Data from the surveys were then used to develop a potential regulatory framework for a filtered or bottled water program following a lead ALE and compare costs for filters versus bottled water provisions as compared to that framework.

# 3 Survey Results

## 3.1 Filters

### 3.1.1 Filter Selection

Respondents were asked to provide information on the type of filter, effectiveness at removing lead, cartridge life expectancy, number of replacement cartridges, costs, accessibility, distribution method, outreach and education, and challenges. Results are summarized in Table 3-1 and are described further below.

*Table 3-1 Summary of Filters by Type*

| System | Filter | Cartridge | Cartridge Life Expectancy | Cost (2022 dollars) | |
|---|---|---|---|---|---|
| | | | | Filter | Replacement Cartridge |
| **Pitcher Filter*** | | | | | |
| Benton Harbor | PUR Plus | PUR Plus Pitcher | 2 months | $31.60 | $26.20 for 2 pack |
| Clarksburg | Brita Monterey Pitchers | Brita Elite | 6 months | $32.53 | $15.55 |
| Denver Water | Brita | Brita Elite | 6 months | $33.06 | $16.55 |

[1] Based on Safe Drinking Water Information System (SDWIS) Federal Reporting Services https://sdwis.epa.gov/ords/sfdw_pub/f?p=108:200

| System | Filter | Cartridge | Cartridge Life Expectancy | Cost (2022 dollars) | |
|---|---|---|---|---|---|
| | | | | Filter | Replacement Cartridge |
| Utility B | Brita | Brita Elite | 6 months | $60.35§ | |
| Utility C | Zero Water | Premium 5-Stage Water Filter | 2 months | $22.00 | $9.20 |
| Utility E | Dupont Pitcher | Universal Pitcher Cartridge | 2 months | $21.80 | $9.70 |
| **Faucet Mounted**** | | | | | |
| Benton Harbor | PUR Plus Faucet Mount | PUR Faucet | 3 months | $19.05 | $25.50 for 2 pack |
| Utility E | PUR Classic Faucet Mount | PUR Faucet | 3 months | $36.30§ | |

* Pitcher filters are NSF/ANSI 42, and 53 certified with a lead maximum permissible concentration of 10 ppb
** Faucet mounted filters are NSF/ANSI 42, 53, and 401 certified with a lead maximum permissible concentration of 10 ppb
§ Cost of filter and replacement cartridges provided as a single value

## Filter Type

Similar to prior studies, the majority of PWSs (five) are providing only pitcher filters, while four have elected to provide their customers with a choice of either a pitcher or faucet mounted filter.[2] Two systems noted that faucet mounted filters were not preferred as they add liability to the utility as it can be challenging for customers to install or maintain such devices. This challenge led Benton Harbor to use Michigan Department of Health and Human Services (MDHHS) preexisting master contract with Home Depot, in which Home Depot is to aid in emergency repairs for the state of Michigan, to in addition aid in addressing and resolving customer concerns with installing and maintaining faucet mounted filters in Benton Harbor. Similarly, Utility A's filter distribution program includes a community outreach and resident education team to assist customers resolve issues pertaining to filter installation and maintenance. It is also important to note that faucet mounted filters do not fit all types of faucets. Therefore, Newark requests customers bring in a photo of their kitchen sink to ensure a faucet mounted filter can be installed on the selected faucet. In the scenario that a faucet mount will not fit on a customer's faucet, Newark will provide the customer with a pitcher filter. The type of filter distributed, whether a pitcher a faucet-mounted device, will be dependent on the requirements set forth by the primacy agency. Two regulators indicated a preference for distribution of faucet-mounted filters was preferable although pitcher filters still met their requirements.

## Filter Effectiveness

All filters distributed by the systems have been certified to NSF/ANSI Standard 53 for lead removal and therefore have demonstrated their effectiveness to reduce lead. As such, additional testing to assess filter effectiveness is

[2] Water Research Foundation (2021) Full Lead Service Line Replacement Guidance. https://www.waterrf.org/resource/full-lead-service-line-replacement-guidance

not warranted; however, in select cases, filter effectiveness studies were conducted as shown in Table 3-2. Three systems – Denver, Newark, and Benton Harbor – each conducted a study through sampling in select homes in their respective communities with suspected LSLs to determine the effectiveness of various filter devices where filters were properly installed and maintained. With few exceptions, sampling results demonstrated that filters when properly installed and maintained were effectively removing lead to levels below 2 ppb or less.

*Table 3-2 System Filter Effectiveness Study*

| Systems | Reason for Filter Study | Type of Filter Tested | Sampling Method | Number of Sampling Events | Results |
|---|---|---|---|---|---|
| Denver[3] | Required by Consent Order; Ensure filter is effective for systems water chemistry | Brita Elite Filter | First Draw and Flushed Tap Sampling | 55 | Filter showed < 2 ppb of lead for all locations but one |
| Newark[4] | Required by Consent Order; New CCT implementation; Ensure filter is effective for systems water chemistry | PUR Faucet and Pitcher filters | First Draw and Flushed Tap Sampling | 337 | 99.5% of filters showed < 10 ppb of lead when used in combination with tap flushing for 5 min |
| Benton Harbor[5] | EPA testing performed due to customer concerns; Ensure filter is effective for systems water chemistry | PUR, Brita, Zero Water Faucet and Pitcher filters | First Draw and Flushed Tap Sampling | 2,000 | All filters tested showed < 5 ppb of lead |

Denver's Lead Reduction Program, as required under their administrative consent order, also included a filter performance study.[3] As part of these tests, Denver reportedly conducted an informal study to assess performance when filters were improperly used, specifically when a filter was used past its life expectancy. This study showed that the Brita Elite filters still effectively removed lead past the manufacturer recommended lifetime. Denver also chose to provide their customers with Brita Elite filters as their study found that Zero Water filters had the unwanted effect of removing fluoride.

[3] Denver Water (2021) Denver Water Lead Reduction Program Semi-Annual Report – S1 2021. https://www.denverwater.org/sites/default/files/lead-reduction-program-semi-annual-report-s1-2021.pdf
[4] City of Newark Department of Water and Sewer Utilities (2019) City of Newark Point-of-Use Filter Study. https://static1.squarespace.com/static/5ad5e03312b13f2c50381204/t/5dd70e112421805afa68ebd9/1574374964737/Newark+Point-of-Use+Filter+Study+-+Aug-Sept+2019+Final.pdf
[5] EPA (2022) Benton Harbor, Michigan, Drinking Water Study Results. https://www.epa.gov/mi/benton-harbor-michigan-drinking-water-study-results

In addition to continuing to use a filter beyond its life expectancy, improper usage could also occur due to improper filter cartridge installation, pour over occurring when using a pitcher filter, issues with operating bypass valve on faucet filters, or due to use of hot water, all of which can impact a filter's ability to remove lead. Consequently, education and outreach are ongoing elements of a filter program and are discussed further in Section 3.1.3.

## Filter Life Expectancy

Filter life expectancy varies greatly depending on the make and model of the filter. Table 3-3 shows the filter life expectancies of the filters used based on manufacturer recommendations. Many systems use Brita Elite filter cartridges due to their longevity, as the Brita Elite filter cartridge has a filter life expectancy of 6-months as opposed to the 2 or 3-month life expectancy of other cartridges. Table 3-4 shows the standard conversion between filter life expectancy in months versus gallons. Both state regulators and systems interviewed are recommending to participating households that filter cartridges be changed when either the maximum life in months or gallons is first met.

*Table 3-3 Filter Life Expectancy by Brand*

| Filter | Cartridge | Cartridge Life Expectancy |
|---|---|---|
| **Pitcher Filter** | | |
| PUR Plus | PUR Plus Pitcher | 2 months |
| Brita Monterey Pitchers | Brita Elite | 6 months |
| Dupont Pitcher | Universal Pitcher Cartridge | 2 months |
| Zero Water | Premium 5-Stage Water Filter | 2 months |
| **Faucet Mounted Filter** | | |
| PUR Plus Faucet Mount | PUR Faucet | 3 months |
| PUR Classic Faucet Mount | PUR Faucet | 3 months |

*Table 3-4 Standard Filter Life Expectancy Conversions*

| Months | Gallons |
|---|---|
| 1 month | 20 gallons |
| 2 months | 40 gallons |
| 3 months | 100 gallons |
| 6 months | 120 gallons |

## Number of Replacement Cartridges

The number of replacement cartridges provided to homes depended on the circumstances in which filters were provided to customers as well as the filter life expectancy. Most systems supply customers with a six-month supply of replacement cartridges at the time of a full or partial LSLR and conduct tap water testing three to six-months after the replacement to monitor lead levels. If the lead levels are above the acceptable level set forth by the primacy agency, either the AL of 15 ppb or the trigger level of 10 ppb, then the system must continue to

supply the customer with replacement cartridges for another 6-months until an acceptable lead level is reached. Due to the longevity of Clarksburg's filter program, they provide a year's supply of filter cartridges at once to customers.

### Accessibility

Systems were able to acquire filters by completing a direct purchase of the desired filters or through a bidding process to multiple contractors or vendors. The base requirement when systems are going through the process of procuring filters is that they are NSF/ANSI 53 certified to remove lead. Clarksburg was unable to obtain the quantity of filters needed in the required timeframe and therefore was required to provide bottled water in the interim until filters were provided.

### Costs

As shown in Table 3-1, unit costs (excluding procurement and distribution) ranged from $22 to $33 for pitcher filters with $10 to $17 per replacement cartridge and $19 to $27 for faucet mounted filters with $13 to $16 per replacement cartridge. This is similar to previous studies where typical filter unit cost ranged from $15 to $50 for pitcher filters, $20 to $30 for faucet mounted devices, and $3 to $10 for replacement cartridges.[6] It is important to note that costs are subject to change based on availability and the state of supply chains. As the cartridge life expectancy varied, costs were normalized for a year and averaged $48.40.

## 3.1.2 Distribution

Survey respondents were asked to provide information on when filters and how filters were distributed, and the costs associated with distribution. Results are summarized in Table 3-5, Table 3-6, and are described further below.

### Distribution Method

As shown in Table 3-5, systems often conducted door-to-door drop offs in conjunction with mailing or communal locations. Most small to medium sized systems (two) distributed filters through door-to-door drop offs and communal locations, whereas larger sized systems (three) distributed filters through door-to-door drop offs and mailing. Note that while Utility B is a large system, they distribute pitcher filters and replacement cartridges to those that have had a PLSLR, as shown in Table 3-6, and since Utility B has been able to perform FLSLRs for the majority of the services investigated, Utility B is able to distribute pitcher filters through door-to-door drop offs for convenience to the customers due to the smaller number of PLSLRs.

Benton Harbor, a small sized utility, has a total of two communal locations open throughout the week for filter and replacement cartridge pick-up, the first being at a local county health department and the second being at a free community clinic. The county health department is open weekdays for 8.5 hours a day, while the community clinic is open Tuesday to Friday (four days a week) for six hours a day for filter pick up.

Newark, a large sized utility, had a total of seven communal locations open for residents to pick up filters and replacement cartridges during their initiation of the program. Of this, five locations were at recreational centers,

[6] Water Research Foundation (2021) Full Lead Service Line Replacement Guidance. https://www.waterrf.org/resource/full-lead-service-line-replacement-guidance

one at the utility facility, and one at the local health department. Recreation centers and utility facility were open Tuesday to Friday for nine hours, and on Saturdays for seven hours per day. The health department was open every day for twelve hours. Newark has also noted that locations and hour's communal locations were open were subject to change based on demand. Therefore, Newark is no longer using recreation centers for distribution and now has a total of three communal locations open which include city hall, health department, and a utility facility. The city hall and health department are open weekdays, eight hours per day for filter pick-ups, while the utility facility is open Monday to Saturday for 10.5 hours per day. Additional considerations around distribution methods are further discussed in Section 3.3.

*Table 3-5 Filter Distribution Method*

| System | Mail | Door-to-door drop off | Communal location |
|---|---|---|---|
| Benton Harbor | X | X* | X |
| Newark | | X | X |
| Clarksburg | | X | X |
| Denver Water | X | X | |
| Utility A | | X* | X |
| Utility B | | X | |
| Utility C | X | X | |
| Utility E | X | X | |

* Door-to-door drop off limited to homebound residents

*Table 3-6 Distribution Events for Filters*

| System | All Residents | Post FLSLR | Post PLSLR | Post LSL discovery | Suspected LSL | Unknown SL material | Major Disturbance | Post meter replacement | High Lead Level (LL) |
|---|---|---|---|---|---|---|---|---|---|
| Benton Harbor | Required by Consent Order | | | | | | | | |
| Newark | | | | Required by Consent Order | | Required by Consent Order | | | Required by Consent Order where LL>15 ppb |
| Clarksburg | | Voluntarily Providing | Voluntarily Providing | Required by Consent Order | Required by Consent Order | Voluntarily Providing | Voluntarily Providing | | Required by Consent Order where LL>15 ppb |
| Denver Water | | Voluntarily providing | Voluntarily providing | Required by Variance | Required by Variance | | Voluntarily providing | | Required by Variance where homes with LL>3 ppb for homes built between 1983 to 1987 with an infant or an expecting family |
| Utility A | Required by Consent Order | | | | | | | | |
| Utility B | | | Required by Consent Order | | | | | | |
| Utility C | | | Required by Consent Order | | | | | | Voluntarily provided to homes with LL>10 ppb |
| Utility D | | Voluntarily providing | Voluntarily providing | | | | | Voluntarily providing | |
| Utility E | | Voluntarily providing | Required by state regulation | | | | | | Voluntarily providing to homes with LL>15 ppb |

### Distribution Costs

Delivery costs for mailing a filter and/or replacement cartridges per year were typically between $13 to $29. It is important to note such yearly mailing costs will also differ based on the mailing frequency a system elects to do. As for communal and drop-off costs, such costs were difficult to determine as system staff often completed such tasks as part of their day-to-day operations or were staffed by volunteers and time was not tracked. Denver Water did report door-to-door drop offs costing about $70 per drop off within their pilot study.[7] Systems that reported using communal locations as a method of provision distribution did not report any costs for purchasing or renting a facility as they adapted pre-existing community or utility facilities to the task. Participating systems also reported no associated costs with storing filters as they used pre-existing facilities. In scenarios where filter provision continues for extended period of time, the use of existing facilities at no cost is an unrealistic planning assumption.

## 3.1.3 Outreach

Prior to a customer's receipt of a filter, state regulators recommend that a customer be notified of the program specifications, how it affects them, and when they will be receiving a filter. This can help alleviate concerns customers may have about the program. Denver Water sends out informational packets to customers to notify them that they will be receiving a filter in two-weeks and provides instructions on how and when to use filters upon receipt. Informational packets clarify that filters should be used for cooking, drinking, and making baby formula and that hot water should not be used when filtering water. Denver also provides customers with the same informational packet when customers receive their filters and bi-annual replacement cartridge packages to ensure customers have continued education on good filter usage practices.

When customers receive their filters, systems often provide the manufacturer's instructions on how to install and maintain the filters. Benton Harbor has also provided additional tap flushing instructions as well as aerator cleaning instructions to all residents within their system to help improve filter performance.

Some water systems perform additional outreach after the customer has received a filter to identify issues and assess filter adoption rates. Benton Harbor, for instance, conducts follow up phone calls to ensure that customers have been able to appropriately install and use their filters. If customers have been unable to install their filters, Benton Harbor provides customers with additional instructions or sends out personnel to assist customers where needed through MDHHS' contract with Home Depot. As part of Denver Water's consent order requirements, Denver sends out annual surveys to customers who have a known or a suspected LSL or have had a LSLR in the last six months to inquire about filter usage along and gather socioeconomic data, where possible.

## 3.1.4 Challenges

Survey respondents noted the following challenges with respect to filter programs:

- **Availability.** When systems were mandated to immediately provide affected customers with a filter, some systems faced challenges with procuring enough filters quickly. This has caused systems, such as Clarksburg, to have to provide bottled water to customers until they were able to secure enough filters. Such

[7] Denver Water (2019) Lead Reduction Program Plan. https://www.denverwater.org/sites/default/files/variance-full-submittal-document.pdf

cases are not ideal, as it will increase overall program costs, but it is a challenge worth considering with the increase of supply chain shortages.

- **Funding.** Systems have also faced challenges initially funding the program as the mandated filter program was unexpected. Recommendations to help mitigate facing issues with funding include engaging state officials to assess what funding opportunities are available to systems as well as reserving emergency funds to help supplement initial costs.
- **Customer challenges.** Participating systems noted similar challenges with respect to customer adoption of filters and proper utilization. Through customer surveys, Denver Water found that customer filter utilization was much lower (64-65% adoption) when used for cooking as compared to a much higher rate (93-94% adoption) when used for drinking. Filter adoption rates can also be affected by a filtration flow rate, as slower flow rates may detract customers from using the filter properly for all usage scenarios.[8] One system also reported challenges after a tap sample reported low lead levels, as some customers stopped the use of filters due to the misconception that the lead sources were no longer present. Other systems that had administered Zero Water filters have reported facing challenges with customers believing that the total dissolved solids reader is depicting lead levels. With regards to filter maintenance, one utility faced challenges with customers replacing filter cartridges more frequently than required.

These challenges reiterate the need to regularly educate customers on the appropriate filter maintenance and usage practices.

## 3.2 Bottled Water

Respondents were asked to provide information on the quantity of bottled water provided, distribution method and frequency, costs, accessibility, outreach and education, and challenges. Results are summarized in Table 3-7 and are discussed further below.

[8] Purchase et. al. (2020) Understanding Failure Modes of NSF/ANSI 53 Lead-Certified Point-of-Use Pitcher and Faucet Filters https://doi.org/10.1021/acs.estlett.0c00709

*Table 3-7 Summary of Bottled Water Programs*

| System | Program Rationale | Length of Program | Quantity of Water |
|---|---|---|---|
| Benton Harbor | Required by consent order to provide to all residents of Benton Harbor | 2019 – Ongoing | Not available |
| Newark | Provided bottled water to residents in the Pequannock System in the midst of the filter program in 2019 when a small-scale filter study found that filters provided to customers were not effectively reducing lead levels and therefore were not meeting the requirements of their consent order[4] | ~ 3 months; provided until a large-scale filter study conducted with the help of New Jersey Department of Environmental Protection and EPA showed that the tested filters resulted in lead levels below the action level | 2 cases per household per day* |
| Clarksburg | Initially provided as part of mandated program due to a lack of filter availability | 2 weeks | Eight 16.9 fl. oz. bottles per person per day |
| Utility A | Provided to residents following detection of elevated lead levels in drinking water | 2016 – Ongoing | Initially 1 case per person per week*, shifted to no limit |
| Utility C | Provided when household tap sample lead level above 50 ppb | 2018 – Ongoing | 1 case* or 4 gallons per household per day |
| Utility F | Required by State to provide bottled water all affected customers where PFAS concentrations where above applicable state maximum contaminant levels (MCLs) | 2016 – Ongoing | No limit |
| Utility G | Voluntarily provided to customers during an emergency | ~ 1 week | 2 cases of water per household per day* |

* The number of bottles per case and ounces per bottle were not specified.

### 3.2.1 Bottled Water Quality

All bottled water distributed by the systems are regulated by the Food and Drug Administration (FDA). Following the Safe Drinking Water Act in 1974, the FDA took responsibility for all bottled water products and ensures that the quality standards are comparable with EPA's standards for drinking water. There are various types of bottled water that are allowed to have different treatments (i.e., mineral water requires at least 250 ppm of TDS); however, all manufacturers are required to follow the Current Good Manufacturing Practice (CGMP). All naturally occurring or added ingredients in the water must be below the maximum exceedance levels permitted by federal or local regulations. The lead exceedance for bottled water is 5 ppb, similar to the NSF/ANSI 53 certification that requires filtered water to contain less than or equal to 5 ppb of lead as of December 2019. No testing of bottled water was done by the utilities to ensure that the contaminates are within regulation as such was done by the FDA.

### 3.2.2 Quantity

Table 3-7 shows the quantity of bottled water each participating system had provided to their customers. Water was typically provided in cases of 16.9 fl. oz. bottles. The specific quantity of water per household per day varied but averaged at 622 fl. oz. (i.e., about 5 gallons per household which equals 37- 16.9 fl. oz. water bottles), which is about 1.89 gallons of water per person per day. The US Army Core or Engineers (USACE) estimates that 1-gallon of water should be provided per person per day for drinking, food prep, and hygiene, and the EPA recommends systems to start off with providing 3 gallons of water per person per day where both recommendations are for emergency drinking water supply scenarios.[9,10] Therefore, results from the survey meet the 1 to 3 gallon recommendations set forth by both the USACE and the EPA. For the purposes of conveying bottled water, it is recommended that systems provide each household with at least one case containing forty 16.9 fl. oz. water bottles per day.

Utility A's bottled water program started off with limiting the amount of bottled water that was given to a household but eventually had no limits on how much bottled water customers could take. This practice led to issues with customers hoarding and creating stockpiles of bottled water.

### 3.2.3 Accessibility

Systems can acquire bottled water by contacting and coordinating with vendors. One utility specifically recommended that, where possible, systems create a contract with a bottled water vendor as part of a their emergency drinking water plan to ensure that vendors will be able to quickly supply systems with the appropriate quantity of bottled waters in an emergency. However, it should be noted that this approach may not be possible for all systems, specifically smaller or rural systems, due to increased costs or lack of nearby bottled water vendors. Anecdotally, respondents also mentioned that, for a short duration, bottled water could be purchased from local grocery stores. However, this approach may not be permitted under typical utility procurement policies or suggests that bottled water may not be held to the same procurement standards as filters. Additionally, even

[9] EPA (2011) Planning for an Emergency Drinking Water Supply. https://www.epa.gov/sites/default/files/2015-03/documents/planning_for_an_emergency_drinking_water_supply.pdf
[10] USACE (2006) quoted in EPA (2011) Planning for an Emergency Drinking Water Supply. https://www.epa.gov/sites/default/files/2015-03/documents/planning_for_an_emergency_drinking_water_supply.pdf

with contracts in place, local stocks can be depleted quickly. Bottled water also has a shelf life and therefore systems may not be able to store a large amount on hand for emergencies. This combination of factors may result in gap between when a system is triggered into providing bottled water and when the customer first receives the water.

### 3.2.4 Distribution

#### Distribution Method

As shown in Table 3-8, most systems (4) distributed bottled water through door-to-door drop offs and communal locations regardless of system size. Utility C only distributes bottled water through door-to-door drop offs as such provisions are provided to a limited number of customers where the lead level is above 50 ppb, as described in Table 3-7. Of the respondents, Utility F was the only system that mails bottled water to customers. Benton Harbor, which is a small sized system, has a total of two communal pick-up locations for their bottled water program that are open asynchronously so that there is one location that is open every day for customers to pick up bottled water. One is located at a community center storage facility while the other is at a local Boys and Girls club. Detailed descriptions of distribution methods considerations are further discussed in Section 3.3.

*Table 3-8 Bottled Water Distribution Method*

| System | Mail | Door-to-door drop off | Communal location |
|---|---|---|---|
| Benton Harbor | | X* | X |
| Newark | | X* | X |
| Clarksburg | | X | X |
| Utility A | | X* | X |
| Utility C | | X | |
| Utility F | X | | |
| Utility G | | X | X |

* Door-to-door drop off limited to homebound residents

#### Distribution Costs

Similar to the filter program, the cost of communal locations and door-to-door drop offs were difficult to determine as system staff completed such tasks as part of their day-to-day operations or were staffed by volunteers and not tracked. Systems also reported no additional expenses regarding bottled water storage or creation of communal locations as pre-existing utility facilities were used. Utility F reported that the cost of mailing of bottled water varied based on the quantity of water delivered to customers. Online research and quotes from various retailers found that bottled water shipping costs are often a flat rate of approximately $10 per delivery in most areas. However, this cost may not be realistic for all systems or all customers withing a single system. Overall, the lack of available data on the required labor and expenses for bottled water distribution suggest that the total program costs for a bottled water program are consistently underestimated.

### 3.2.5 Outreach

Utility G conducts community outreach through local media, reverse 911, local news sites, and social media as a means of notifying customers of where and when bottled water will be available for the community. Similarly, many systems (3) have also reported using their existing websites, which are updated frequently, to list locations of communal pick-up sites as well as hours of operations. Utility F sends out a letter to individual households notifying customers of the intent of the program and that they will be receiving bottled waters until a point-of-entry treatment system was installed in their households and found to be sufficiently removing PFAS. Costs associated with the above outreach efforts were not tracked separately and able to be reported.

### 3.2.6 Costs

Bottled water costs from the participating systems averaged at $7.40 for a forty (40) 16.9 fl. oz. case of water bottles (or total volume of 676 fl. oz.), as shown in Table 3-9. In comparison, the average cost of a 5-gallon jug, at a total volume of 640 fl. oz. which is less than a 40-pack of 16.9 fl. oz. bottles, ranges from $9.00 to $13.00 across thirteen different commercial bottled water delivery service providers in the U.S.[11] Additional online research of costs of bottled water pallets from major bottled water companies showed that a 40-pack of 16.9 fl. oz. bottles averaged between $9.00 to $12.00 nationwide. Therefore, it is found that survey reported costs were lower than commercially available bottled water costs.

In total, Clarksburg's two weeklong bottled water program serving a medium size population cost approximately $14,500 in 2021. An additional $10,000 went towards distributing bottled water. Clarksburg also received 2,000 cases of bottled water by the State of West Virginia, which cost approximately $13,200. Utility G's week-long long program for a medium sized system cost approximately $130,000. This includes all the costs for program initiation, customer communication, rental of equipment to move supply of bottled water and set up distribution points, cost of hiring security to manage distribution centers, and the cost of purchasing bottled water. Utility G reported that each truck load of bottled water cases cost approximately $10,000 each.

*Table 3-9 Bottled Water Costs*

| System | Bottled Water Size | Quantity (fl. oz.) | Reported cost for purchased quantity of bottled water* | Equivalent cost for 40-pack of 16.9 oz bottles* § |
|---|---|---|---|---|
| Clarksburg | 40-pack of 16.9 oz bottles | 676 | $4.34 | $4.34 |
| Utility F | 24-pack of 16.9 oz bottles | 406 | $5.99 | $9.98 |
| | 5-gallon bottle | 640 | $6.50 | $6.87 |
| | 6-pack of 1 gallon bottled | 768 | $9.49 | $8.35 |
| **AVERAGE** | | | | $7.40 |

*Costs represented in 2022 dollars

§ Survey responses for bottled water costs varied by size, quantity. Costs were normalized to estimate the equivalent cost for a 40-pack of 16.9 fl. oz. bottles, resulting in an average cost of $7.40 per case.

[11] FIXR (2022) How much does it cost to have bottled water delivered? https://www.fixr.com/costs/bottled-water-delivery

### 3.2.7 Challenges

Survey respondents noted the following challenges with respect to bottled water programs:

- **Accessibility.** Systems reported challenges with obtaining the needed quantity of bottled water for their affected customers. Where possible, systems are recommended to create an emergency drinking water supply plan that includes agreements with local or national vendors to supply bottled water, both of which can help to quickly stand up a bottled water program. The emergency plan can also ease the task of communicating and coordinating with necessary parties, such as the county operations of emergency management (OEM) and security for communal pick-up-locations. However, it is important to note that emergency plans are typically designed to address situations of a short duration and that costs associated with this approach are likely to be more significant. As such, systems should consider more sustainable, long-term options when planning for extended distribution of bottled water as part of a regulatory compliance program. In addition, this approach may pose as a challenge for smaller systems, who often have fewer resources and/or are located in more rural locations that are less likely to have nearby bottled water facilities. Several utilities also expressed challenges with balancing the amount of water needed based on consumption rates to ensure there are enough bottled waters to distribute to customers while limiting the amount of storage space needed.
- **Program termination.** Several of the programs described above were initiated without a prior agreement to when the program will be terminated. This has resulted in challenges obtaining agreement among stakeholders as to when customers can return to treated water, even if lead levels have been in compliance with all federal and state requirements. This further exacerbates the lack of trust from the community, which can impact long-term water use and the ability of the utility to make future investments. In addition, there is typically an abundance of bottled water left over after the termination of a program, due to systems needing to always have an excess supply to ensure they can meet customer demands. This leads to systems to face challenges with distributing left-over bottled water so that bottles are utilized by the time they reach their shelf life of twelve months. Utility G typically stores a portion of the bottles in their facilities and donates excess bottled water to organizations such as the Red Cross, US Army, and schools.
- **Distribution.** While communal locations were the most common distribution method, systems noted challenges tracking how much water was being distributed to a given household. In extreme cases, customers from other service areas were requesting water, some were found to stockpile bottled water, and some were re-selling the water.

## 3.3 Distribution

Distribution methods employed by utilities can greatly differ based on the structure of the filter or bottled water program, whether that be a short-term or long-term program as well as the population of community that requires a filter. Bottled water programs also require much more frequent distribution, which could impact the selected method(s). Table 3-10 summarizes several considerations when deciding on a delivery method based on feedback from the survey respondents. Additional detail is provided below.

### 3.3.1 Methods

#### Communal pick-up locations

Communal locations were found to be the most convenient delivery method to customers initially as mailing can take time to set up and door-to-door drop offs are not as efficient.

- **Distribution points.** Viable distribution points need to be used for communal-pick-up locations for customers to receive bottled water and filter provisions. Survey responses have shown that distribution locations were created at pre-existing utility facility locations or local community centers. Participating systems also reported that utility facility locations were used for filter and bottled water storage.
- **Number of communal locations.** The number of communal locations for filter and bottled water programs were similar. Benton Harbor has four total communal locations, two for their filter program and two for their bottled water program. Newark had seven communal locations during the height of their filter program but now has only three communal locations.it is also important to note that the days and times each location was open varied. Also, in some cases, systems noted that customers did have to wait in line for bottled water pickup.
- **Customer verification.** When picking up filters or bottled water from a communal location, some utilities require ID's or proof of residency whereas other utilities do not require any ID's due to a concern of filter access for undocumented community members. When ID's and proof of residency are not required, systems can run the risk of having customers take advantage of resources. Alternatively, some systems, such as Benton Harbor, require an address within the system and a name, but no proof of residency or ID.
- **Communal location considerations.** Additional considerations for distribution points include ensuring communal locations able to accommodate traffic flow as well as equipment such as forklifts to move bottled water or filters, tankards, and traffic cones. This could require additional planning and coordination, particularly in large metropolitan areas. If a pop-up distribution location is used, equipment such as shelters, restrooms, and lighting need to be considered. EPA's "Planning for an Emergency Drinking Water Supply" document outlines recommendations and considerations when establishing a communal location for emergency distribution of water, including an example configuration, and can serve as a starting point for planning purposes.[9] In several instances, volunteers were used to support distribution. While this was critical to the success of the surveyed programs, it is important to note that water systems cannot be expected to rely of volunteer support for a long-term compliance program. Systems would need to identify and hire the necessary laborers to staff communal locations to achieve regulatory compliance. Third party security can also be hired to maintain distribution points and bottled water supply. Distribution events can also be held to increase customer participation in the program. Benton Harbor has hosted distribution events at their local farmers markets. Systems have also held such distribution events during town meetings.

*Table 3-10 Comparison of Distribution Methods*

| Method | Filter Program | Bottled Water Program |
|---|---|---|
| Mailed | × Difficult to provide within an emergency or short timeframe<br>✓ Mailing can be cheaper due to weight, but can be damaged or lost during delivery | × Difficult to provide within an emergency or short timeframe<br>× Mailing can be expensive due to weight and frequency of shipment |
| | × Some addresses can be "undeliverable" (i.e., customer must be present for delivery or address does not exist) | |
| Door-to-door drop off | ✓ Does not require as much cargo space as bottled water door-to-door drop offs | × Requires significant cargo space when conducting door-to-door drop offs |
| | × Real-time tracking can be more challenging; can require additional documentation to verify the customer received the kit or water and reduce chance of either being left on porch/door and stolen<br>✓ Can complete during regularly scheduled delivery or can call utility for delivery | |
| Communal pick-up location | ✓ Does not require as much space as bottled water at communal pick-up location | ✓ Can provide within an emergency or short timeframe<br>× Requires significant space at communal pick-up locations |
| | × Can pose challenges for some customers to get to the location; multiple locations often needed<br>× Requires significant staff and physical space for storage and logistics on location | |

## Door-to-door drop offs

Most systems, such as Benton Harbor, Utility A, and Newark, only provide door-to-door drop offs of filter and bottled water for homebound residents or for those that need special accommodations. Utility B have a limited number of instances that require filters to be provided to the customer and so only conduct door-to-door drop offs of filters. Utilities also provide field workers with filters or bottled water to distribute to customers on an as needed basis when completing work orders and field inspections. When having field staff distribute provisions, it is important for them to have appropriate identification and materials to prove to customers that they are a part of the utility and are not impersonators. It is also imperative that field staff are trained to answer any questions that customers may have.

## Mailing

Unlike other delivery methods, mailing of filters were often found to include additional costs such as labor costs to build filter kits, cost of shipment, and boxes. Denver has opted to mail out singular cartridges once every six months, instead of two cartridges at once every year. Although such methods will increase project costs for delivery, it is a method that can improve customer filter practices. Although mailing bottled water to homes incurs additional costs for mailing, it will reduce the number of total laborers needed for bottled water distribution. Utility F mails bottled water to each home until a point-of-entry treatment system is installed and operational.

### 3.3.2 Challenges

Survey respondents noted the following challenges with respect to distribution:

- **Filter Program.** Systems have reported facing challenges with having the most up to date list of addresses and residents, especially for apartment buildings or multi-family rentals with many tenants. Since most rentals have the landlord directly pay for water, rather than having the water account in the tenant's name, it can be difficult to track when tenants move in or out of a unit. Denver Water evaluated this situation and found it necessary to work with local rental agencies and leasing offices to notify the system when a tenant moves in or out. With this additional engagement, Denver was able to identify households to mail out pitchers, replacement cartridges, and informational packets within the timeframe of 35 days required by the system's variance conditions. Denver Water also tracks changes in customer accounts to ensure delivery reaching targeted households. Other systems, such as Benton Harbor, have incurred additional costs to obtain a certified list of addresses for their system. Utility E has reported facing challenges with having filters distributed on time to customers who have had a service line replaced when conducting door-to-door drop offs. To rectify this, Utility E has educated field staff to emphasize steps to assure timely deliveries. It is also important to note that the LCRR has additional filter distribution requirements that should be considered when initiating a filter program**.**
- **Bottled Water Program.** Systems reported experiencing challenges with storing bottled water at communal pick-up locations as well as field staff having sufficient space to store cases of bottled water in their vehicles during door-to-door drop offs due to the bulkiness and quantity of bottled waters needed. Some systems, such as Utility A, have reported facing issues with non-residents taking bottled water from communal pick-up locations. Utility A and Clarksburg have also experienced customers stockpiling bottled waters in their homes and taking more provisions than needed. Utility G, on the other hand, reported that such occurrences were typically very minimal and did not affect their bottled water supplies drastically.

# 4 Hidden Costs

Implementing a filter or bottled water program can come with additional hidden costs that need to be taken into consideration which will be discussed in the following section.

- **Program implementation.** When initiating a filter program, some systems did not have immediate access to filters and therefore had to provide affected customers with bottled water. This can be due to supply chain shortages, contract bidding process, direct purchase process, driver shortages etc. It cost Clarksburg approximately $15,000 to supply their affected customers with bottled water for two weeks until they were able to provide their customers with filters. Upon acquiring the filters, some systems also reported having issues with managing their filter stock, whether that be with having enough filters to distribute or having enough space in a warehouse to store all the filters. Benton Harbor also spent an additional $10,000 to obtain a certified list of addresses for their system.
- **Delivery.** Systems that have conducted door-to-door drop offs have reported that there is a noticeable amount of additional costs associated with paying field workers overtime to complete the drop offs. Utility B also reported such costs would increase if customers were not home and field workers had to visit customer homes multiple times. As for systems that have mailed filters to customers, some have reported incurring additional costs for replacing damaged or stolen filters. For example, it cost Clarksburg approximately $3,000

to replace damaged filters. In addition to this, delivery costs can also be subjected to increasing with the implementation of multiple delivery methods.

- **Data management.** Data management platforms was the most common unexpected cost systems had reported. Such platforms can be used to record locations that have been contacted about a program, have received a filter or bottled water provision, and have a list of customers that should receive replacement cartridge. Such platforms are multifaceted and can also be used for data collection for other purposes by the system. Therefore, data management platform costs are not strictly just for bottled water and filter program purposes, but it is instead a cost shared for all needs of data management a system may require.
- **Communication.** Multiple forms of communication are recommended to improve customer outreach but can be costly to implement. Denver had reported that one of their unexpected costs was with customer communication material, including creating material in different languages to be able to reach and engage all community members.

# 5 Terminating a Program

Unlike the LCRR requirement to provide filter cartridges for six months following a LSLR or major disturbance, there is no federal requirement to provide filters or bottled water after a lead ALE. Once required, terminating a program can be challenging. Many of the programs discussed above did not have a clear definition on how long the program would need to continue before it began, which made it increasingly difficult to define a stopping point.

The timing of the termination of the program should be set and communicated *before* the program is initiated as this will set expectations and support clear messaging to customers. Potential options for terminating a filter or bottled water program were considered and include:

- **A demonstrated reduction in lead levels.** When a program is initiated due to an ALE, a programs natural termination may be when the lead levels are below the action level. An example could be when the 90$^{th}$ percentile is below the action level for two monitoring periods (as is the case with LSLR under the LCRR). Another option may be an even lower value, such as below the practical quantitation limit (PQL); however, even in systems with well-maintained CCT, this concentration can be difficult to achieve at the 90$^{th}$ percentile especially with the changes in the sampling pool and method in the LCRR.
- **Installation of corrosion control treatment.** If a system does not have corrosion control in place, the program could end when corrosion control is implemented and deemed optimized; however, in many cases optimal CCT can be challenging to define and/or CCT may not be able to fully address particulate release.
- **Removal of lead service lines.** If the lead sources that contributed to the action level exceedance (such as LSLs) are removed, the program may end. This may be viable for systems with few LSLs but could be very costly for those with thousands of LSLs as it could take years or decades for these systems to fully replace LSLs.

Regardless of the final criteria selected, state regulators and survey respondents advise systems to be transparent with community members by communicating and educating them about the meaning of the mandate, who qualifies for the program, how it affects them, what the system is going to do to ensure the community is protected, and that the program will eventually terminate.

**Stakeholder identification and engagement.** Once the goals and measures of success have been defined, successful efforts identified stakeholders to target for communication efforts. Set expectations at the outset of the program was followed by ongoing communication through the life of the project. Stakeholders can be both internal and external and can include system directors, pediatricians, and trusted community leaders.

**Messaging and Outreach**. A successful communication campaign entails messaging through multiple outlets. Messaging begins at the onset of the program with training staff in appropriate messages. There are a variety of modes of public communication; system staff will need to select among them for best effect, including:

- Letters (mailed, emailed)
- Phone calls
- Public meetings (in-person and online)
- Hotline (24/7 or business hours with multiple languages)
- Infographics/brochures
- Website
- CCR
- Door-to-door

# 6 Cost Comparison

To directly compare costs between a filter or bottled water program following an ALE, costs were developed for each program assuming that the system was required to provide bottled water or filters to residents for a full year. Costs were developed for two size categories (1) a medium size system with a population served of 16,000 (2) a large size system with a population served of 330,000, in which the entire population of each sized system are eligible for a filter or bottled water. All costs are presented in 2022 dollars and included upfront costs for public education and outreach and recurring costs for materials, distribution, public education and outreach and labor developed based on cost information provided by the participating systems documented above and supplemented by publicly available pricing data, where possible.

Several key assumptions were made including:

- Entire population will receive filters or bottled water
- Bottled water and filters are readily available
- No overtime labor is required for drop-offs or at communal locations
- No supplies are damaged or stolen upon delivery
- No volunteer labor is included
- Systems have a complete list of addresses available at the onset as each system will require this for compliance with the LCRR
- Utility owned facilities are available for communal pick-up locations and storage
- Utilities have pre-existing data management systems in place to track data (e.g., distribution, costs, etc.)
- Pitcher filters would be provided and are NSF/ANSI 53 certified filter for lead removal
- There are 2.6 people per household
- Communal locations are open seven days a week

### 6.1.1 Upfront Costs

The cost of developing educational materials in multiple languages and formats is the primary upfront cost considered within this program cost approximation and were developed based on Denver's Filter Pilot Study from 2019, which reported the development of educational materials and survey took approximately 200 hours with labor costs at $192 per hour.[7] This led to an overall cost of developing education materials to come to be $38,400.

This cost is presumed to be consistent across varying system sizes as the same types of materials and informational content will not change with system size.

### 6.1.2 Recurring Costs

#### Printing Material Cost

The cost of printing educational material was approximated to be $0.92 per household by the EPA and includes the cost of paper, envelope, postage, and door hangers.[12] For each program type, it is presumed that printing and delivery will occur to each customer twice a year, or $1.84 per household per year.

#### Labor Costs and Roles

- **Labor Costs**. Labor costs were based on managerial and administrative staff rates from EPA's economic analysis document.[12] Engineering rates were assumed to be equivalent to a managerial labor rate the same rates. All labor costs were inflated using the U.S. Bureau of Labor Statistics total compensation employment cost index for state and local government workers and were fully loaded to include a fair labor rate, benefits, and overhead costs as shown in Table 6-1.
- **Labor Roles.** Responsibilities for administrative staff include addressing or making customer calls, staffing communal locations, completion of door-to-door drop offs of filters or bottled water, and building of filter kits. Managerial staff would provide general program oversight and be responsible for product procurement. Engineering staff would be responsible for data logging and tracking. For the purposes of developing program costs, engineering staff are only considered for a large sized system as such systems will have a greater quantity of information to document. It is important to note that the number of staff required per system size and program type reflects the total number of staff required for the program, and so does not rely on volunteers for program operation.

#### Labor Quantity and Distribution

The number of employees required for a program is dependent on system size, program type, and method of distribution. As system size increases, the total number of employees will also increase as there will be more provisions to distribute. As for the program type, a bottled water program requires a total number of employees that is greater than or equal to the number of employees needed for filter program for a system of a similar size. The number of employees needed for each type of program is dependent on the distribution method. Overall, every program, regardless of size, will need at least one program manager. Larger systems will also require one engineer to log and track data.

- **Communal.** Communal locations will require at least one administrative staff per pick-up station with an additional one to two staff per communal location to ensure there is at least one person available per pick-up station while a staff may be on break. Note that there may be multiple pick-up station at a singular communal location.
- **Door-to-door.** From the survey responses, it was found that door-to-door drop is offered to customers that are homebound and unable to pick up bottled water or filters from communal locations. A 2011 study that

[12] EPA (2019) Economic Analysis for Proposed Lead and Copper Rule Revisions. https://downloads.regulations.gov/EPA-HQ-OW-2017-0300-0003/content.pdf

surveyed community dwelling elders 65 years and older found that approximately 5.6% were homebound which is approximately 0.65% of the total U.S. population in 2011.[13] Therefore, this 0.65% approximation can be used to find the total number homebound residents in a system which will determine the number of administrative personnel needed to complete door-to-door deliveries within a reasonable time given an 8-hour workday.

- **Time.** Approximations of the time it takes to complete a door-to-door delivery for a small to medium and large systems for a filter and bottled water is shown in Table 6-2.[12] Large sized systems have a drop-off time per household about 25 minutes greater than small to medium sized systems due to the increased travel time required for a larger service area. Bottled water programs have a drop-off time per household about five minutes greater than a filter program due to the larger quantity of water that needs to be brought to each home.
- **Filters.** The time to complete a singular door-to-door-drop off, as listed in Table 6-2, was used to estimate the total number of employees required to complete all drop-offs to homebound residents in a given system. This was found through assuming systems can delivers filters within 90 days given an 8-hour workday. 90 days was used as a basis as state regulators have required Denver Water to have an active filter program within 90 days of program initiation, as part of their consent order.
- **Bottled Water.** The time it takes for bottled water to be dropped off was used to estimate the total number of employees required to complete all drop-offs to homebound residents. Bottled water drop-offs occur on a bi-weekly basis so that homebound customers have appropriate quantities of water available to them while the water bottle supplies do not take up an excessive amount of space in each household. Therefore, the number of employees required to complete drop-offs of bottled water to homebound customers was found assuming drop-offs can be completed every fourteen days given an 8-hour workday.

- **Mailing.** Mailing provisions to customers will reduce the total number of employees required to distribute provisions to customers but does require additional costs for shipping.
  - **Filters.** It is estimated that it takes three minutes to build a singular filter kit. Therefore, for systems to provide their customers with filter kits within 90 days of program initiation, a small to medium sized system requires approximately one to two people, while a large sized system will approximately require three to six people to build filter kits.
  - **Bottled Water.** It is assumed that mailing bottled water to homes will require no additional labor to distribute provisions as such labor would be outsourced to the bottled water distributors.

[13] Ornstein KA, Leff B, Covinsky KE, et al. JAMA Intern Med. (2015) Epidemiology of the Homebound Population in the United States. https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2296016

*Table 6-1 2022 Estimated Labor Rates*

| System size | 2007 Wage* A | | 2022 Wage** B = A * 1.44 | | 2022 Wage + Benefits¥ C = B *1.62 | | 2022 Wage + Benefit + Overhead§ D = C *1.1 | |
|---|---|---|---|---|---|---|---|---|
| | Manager | Administrative | Manager | Administrative | Manager | Administrative | Manager | Administrative |
| <=100 | $24.06 | $16.21 | $34.65 | $23.34 | $56.16 | $37.83 | $61.78 | $41.61 |
| 101-500 | $24.06 | $16.21 | $34.65 | $23.34 | $56.16 | $37.83 | $61.78 | $41.61 |
| 501-1,000 | $24.06 | $16.21 | $34.65 | $23.34 | $56.16 | $37.83 | $61.78 | $41.61 |
| 1,0001-3,300 | $24.06 | $16.21 | $34.65 | $23.34 | $56.16 | $37.83 | $61.78 | $41.61 |
| 3,301-10,000 | $27.51 | $16.21 | $39.61 | $23.34 | $64.20 | $37.83 | $70.62 | $41.61 |
| 10,001-50,000 | $30.65 | $20.93 | $44.14 | $30.14 | $71.54 | $48.85 | $78.69 | $53.74 |
| 50,001-100,000 | $35.76 | $20.93 | $51.49 | $30.14 | $83.45 | $48.85 | $91.80 | $53.74 |
| 100,001-1M | $38.21 | $20.93 | $55.02 | $30.14 | $89.17 | $48.85 | $98.09 | $53.74 |
| >1M | $40.51 | $20.93 | $58.33 | $30.14 | $94.54 | $48.85 | $103.99 | $53.74 |

* Base Hourly Wages from Exhibit 4-59. Values were adjusted to unloaded labor rate through taking out 1.4 benefit multiplier [12]

** Values adjusted to 2022 dollars through applying BLS state and local government compensation values from Q2 2007 (38.61) and Q2 2022 (55.47). Multiplier used was 55.47/38.61 or 1.44

¥ Labor rates were loaded to include benefits for paid leave, supplemental pay, insurance, retirement and savings, and legally required benefits such as social security and Medicare. Benefit multiplier found from BLS at a rate of 1/0.617 or 1.62 for state and local government employees[14]

§ Labor rates adjusted to include overhead costs through using a standard multiplier of 1.1. Overhead costs include facility operation and maintenance costs such as insurance, rent and utilities along with general administrative costs such as human resources, legal, regulatory compliance, and accounting.

[14] U.S. DOL Bureau of Labor Statistics (2022) Employer Costs for Employee Compensation – June 2022. https://www.bls.gov/news.release/pdf/ecec.pdf

*Table 6-2 Approximate Door-to-Door Drop Off Times*

| System Size | Filter Program (Hours per home) | Bottled Water Program (Hours per home) |
|---|---|---|
| Small to Medium | 0.75 | 0.84 |
| Large | 1.17 | 1.25 |

## Additional Distribution Costs

Along with distribution labor costs, mailing bottled waters and filters have additional costs for shipment.

- **Mailing bottled waters.** Cost of mailing bottled water was approximated through using costs provided by Utility F and through online research from bulk water suppliers. Through this, it was approximated that mailing bottled water was about $10 per delivery frequency. It is also presumed that bottled water delivery will occur weekly.
- **Mailing filters.** The cost of mailing filters was approximated through using costs provided by participating systems and through online research from commercial mail carriers. Through this, it was approximated that mailing filters will cost about $13 per event, with two events per year. In addition to this, the cost of a box for mailing is about $1.03 per filter kit that contains a filter and replacement cartridge, and $0.46 per kit that contains only additional replacement cartridges. Therefore, the average cost of a box is estimated to be $0.75.

Although research found bottled water delivery to be $10 and mailing filters to be $13, delivering bottled water for a yearlong program will still be costlier than delivering filters and replacement cartridges. This is due to bottled water delivery occurring much more frequently than the biannual delivery of filter replacements.

## Bottled Water Program

It is estimated that each household should receive at least one case of forty 16.9 fl. oz. bottles everyday where each case will cost approximately $10. Bottled water cost was found through averaging system reported costs, as well as commercial bottled water costs as specified in Section 3.2.6. Overall, this quantity if water allows each household member to receive approximately 2 gallons of water per day, which falls within USACE's and EPA's recommendation of between 1 to 3 gallons per person per day.[9,10]

## Filter Program

For the purposes of this study the filter program is structured so that homeowners will first receive a filter with a 6-month supply of replacement cartridges. Once the 6-month mark of the program is reached, homeowners will once again receive another 6-month supply of replacement cartridges. To account for the cost of additional filters required due to new customers moving into the service area and for broken or lost filters, it is assumed that 11% of households will require an additional new filter after the initiation of the program per year. This was estimated

from the U.S. 2018 to 2019 Census in which about 10% of the U.S. population had moved.[15] In addition to that, it was assumed that about 1% of the households within a system will experience a broken or lost filter. Unit costs are summarized in Table 6-3.

- **Filters.** Based on survey data, the average cost of a filter was estimated to be $33 per filter.
- **Cartridges.** Based on survey data, the average cost of a filter replacement cartridge will be $12.10 for a filter with a 3-month life. Therefore, the total cost a filter replacements per household will be $48.40 per year.

*Table 6-3 Approximate Costs of a Program per Household*

| Cost Specification | Filter Program | | Bottled Water Program | |
|---|---|---|---|---|
| | Per unit | 1-year long program | Per unit | 1-year long program |
| Filter / Bottled Water | $33 | $33 | $10 | $3,640 |
| Replacement Cartridge (3-month life) | $12.10 | $48.40 | - | - |
| Printing Educational Material | $0.92 | $1.84 | $0.92 | $1.84 |
| Mailing | $13.00 | $26.00 | $10 | $520 |
| Box | $0.75 | $1.50 | - | - |

### 6.1.3 Annual Costs

To approximate the yearly cost for a filter and bottled water program, it was assumed that the delivery method of provisions to 99.45% of households is through communal locations and 0.65% is completed through door-to-door drop off. An example cost was developed using a population of 16,000 for a medium sized system, and a population of 330,000 for a large sized system. It is approximated that there are 2.6 people per household, and so this factor was used to find the total number of households for each system. Therefore, the medium system will need to complete 41 door-to-door drop offs, whereas large system would have to complete 826 door-to-door deliveries to homebound customers.

With having the total number of households to deliver to, an approximation of the number of staff needed for the program was found for the medium system and for large system, as seen in Table 6-4 and Table 6-5. The count of administrative workers required for door-to-door delivery was found through ensuring filters will be delivered within 90 days and bottled water is to be delivered within 14 days given an 8-hour workday. Table 6-6 shows the approximate days it would take the specified number of administrative staff to complete all door-to-door drop offs. It is important to note that the size of the system will affect the type of service customers will receive for door-to-door drop offs. For example, Table 6-6 shows that a medium sized system will receive bottled water within three days between two staff versus a large system, which will take thirteen days between ten staff. Similarly for a filter program, a medium sized system will be able to receive their filters within four days with one staff member completing all drop-offs, versus a large system, which will take 61 days between two staff members. In addition,

[15] U.S. Census (2019) Geographic Mobility: 2018 to 2019
https://www.census.gov/data/tables/2019/demo/geographic-mobility/cps-2019.html

those in a larger system may be required to store more water in their house at a time, as a larger system will not be able to make door-to-door drop offs to a singular home as often as a smaller system.

*Table 6-4 Approximate Number of Staff Needed for an Example Medium Sized System (Population 16,000)*

| Laborer | | Filter Program | Bottled Water Program |
|---|---|---|---|
| Administrative | Communal / Telephone | 2 | 6 |
| | Door-to-Door Drop Off | 1 | 2 |
| Manager | | 1 | 1 |

*Table 6-5 Approximate Number of Staff Needed for an Example Large Sized System (Population 330,000)*

| Laborer | | Filter Program | Bottled Water Program |
|---|---|---|---|
| Administrative | Communal / Telephone | 16 | 125 |
| | Door-to-Door Drop Off | 2 | 10 |
| Manager | | 1 | 1 |
| Engineer | | 1 | 1 |

*Table 6-6 Total Door-to-Door Drop Off Time*

| System Size | Filter Program (days) | Bottled Water Program (days) |
|---|---|---|
| Medium System (Pop. 16,000) | 4 | 3 |
| Large System (Pop. 330,000) | 61 | 13 |

A filter program serving a medium sized system of 16,000 people will require one communal location with one pick-up station, as seen in Table 6-7, as such number of communal locations was found for similar sized systems within this study. A filter program serving a large sized system of 330,00 people will require eight communal locations with one pick-up station at each communal location, as seen in Table 6-7. This count of communal locations was found through escalating Newark's reported seven locations for approximately 294,000 to account for a system with 330,000 people. With that, each communal pick-up station will require two administrative workers. Therefore, the medium utility will require a total of two administrative employees to staff the communal location, whereas the large utility will require a total of 16 employees to staff their communal locations.

The count communal locations needed for a bottled water program, as depicted in Table 6-7, was found through using the USACE standard of 12 loading points needed to serve 20,000 people (or customers) per day.[10] Using this as a starting point, it was assumed that four pickup loading points are required for a medium system serving

16,000 people (or 6,154 households or customers), which is divided between two communal locations. Therefore, a total of six administrative staff were assumed for the communal locations, as shown in Table 6-4, as there will be one person per station, with an additional two people to aid with loading and ensuring every station has a person. Similarly, a large system with 330,000 people (or 126,923 households or customers) will require 76 pickup loading points, which is divided between 25 communal locations in which each location will have roughly three stations. Therefore, a total of 125 administrative are required to staff all the communal locations, as shown in Table 6-5, as there will be one person per station, with an additional two people to ensure each station has staffed for breaks/rotations.

*Table 6-7 Total number of Communal Locations*

| System Size | Filter Program | | Bottled Water Program § | |
|---|---|---|---|---|
| | Pick-Up Stations | Communal Locations | Pick-Up Stations | Communal Locations |
| Medium System (Pop. 16,000) | 1 | 1 | 4 | 2 |
| Large System (Pop. 330,000) | 8* | 8 | 76 | 25 |

* Value was estimated using communal locations found in Newark
§ Value was estimated using USACE Emergency Support Function (ESF) #3 Field Guide which states 12 Loading points are needed to serve 20,000 persons per day.[109]

Based on the items above, it is approximated that a 1-year long filter program for a medium sized system will cost about $1.07M while a bottled water program will cost about $23.5M. For a large sized system, a 1-year long filter program will cost about $13.7M while a bottled water program will cost about $477.8M. Therefore, it is determined that a filter program will be less costly than a bottled water program regardless of system size, as seen in Table 6-8.

*Table 6-8 Estimated Annual Program Costs**

| System Size | Filter Program | Bottled Water |
|---|---|---|
| Medium System (Pop. 16,000) | $1,070,000 | $23,510,000 |
| Large System (Pop. 330,000) | $13,700,000 | $477,770,000 |

*All costs rounded to the nearest $10,000.

### 6.1.4 Lead Service Line Replace Cost Comparison

Using the sample program costs found in Table 6-8, the approximate number of LSLs that could be replaced in lieu of a filter or bottled water program are shown in Table 6-9 assuming a LSLR costs $12,500.[16] With this, it is found that the cost of a 1-year long bottled water program could replace 1,880 LSLs in a medium system with a population of 16,000 and 36,221 LSLs in a large system with a population of 330,000. The cost of a 1-year long filter program could replace 85 LSLs in a medium system with a population of 16,000, and 1,095 LSLs in a large system with a population of 330,000.

*Table 6-9 Number of Lead Service Line Replacements that can occur based on Sample Filter and Bottled Water Program Costs*

| System Size | Filter Program | | Bottled Water | |
|---|---|---|---|---|
| | Program Cost | Equivalent No. of LSLRs | Program Cost | Equivalent No. of LSLRs |
| Medium System (Pop. 16,000) | $1,070,000 | 85 | $23,510,000 | 1,880 |
| Large System (Pop. 330,000) | $13,700,000 | 1,095 | $477,770,000 | 38,221 |

# 7 Conclusion

Experiences and costs for filter and bottled water programs were documented through interviewing eleven systems within the U.S. Most systems did not have complete costs for their respective programs and so additional online research was incorporated to develop complete filter and bottled water program costs. In doing so it was found that:

- Bottled water programs are significantly costlier than filter programs which is largely due to the cost of the bottled water and frequency with which it must be distributed to the customer (ex., biweekly as compared to every six months for filters).
- Systems typically use more than one distribution method which can increase program costs.
- Procurement challenges (i.e., utility requirements to obtain multiple bids, supply chain shortages) and storage constraints (for bottled water programs only) have been shown to complicate initial distribution and result in short-term increases in program costs.
- The number of desired communal locations for distribution and associated staffing needs may become impractical for larger size systems, particularly for bottled water programs, resulting in longer wait times and lower levels of service.
- Systems will typically face hidden costs associated with administrative overtime and data management.
- Bottled water program costs are equivalent to replacing thousands of lead or galvanized requiring replacement service lines. Additionally, bottled water programs can further reduce customer confidence

[16] CDM Smith (2022) WITAF 072 Considerations when Cost Lead Service Line Identification and Replacement

in the quality of the water service they receive, which can impact long-term water use and the ability of the utility to make future investments.

- Systems should conduct customer outreach and education with clear and concise messaging at all phases of the program.
- The timing of the termination of the program should be set and communicated *before the program is initiated* as this will set expectations, help maintain customer confidence and support clear messaging to customers.

# Appendix A

## Survey Template

American Water Works Association

*Dedicated to the World's Most Important Resource®*

# WITAF

## 073: Filter and Bottle Water Provision

**Case Studies- Request for Information**

### Utility Information

Utility Name: _____ Date: _____

PWS ID: _____

Contact Name: _____

First Last

What is the population served by your utility? _____

Do you have lead service lines as defined by the EPA in your system? ☐ Yes ☐ No

Has your system been triggered into supplying bottled waters or filters? ☐ Yes ☐ No

Are you comfortable with having your utility be in a case study, blinded or not? ☐ Yes ☐ No

Would you like all data to be blinded? ☐ Yes ☐ No

### Filter Program

#### PROGRAM BACKGROUND

Has your water system implemented a program using water filters? ☐ Yes ☐ No

Does your water system routinely provide water filters to customers;

After a full lead service line replacement? ☐ Yes ☐ No

After a partial lead service line replacement? ☐ Yes ☐ No

After a major disturbance? ☐ Yes ☐ No

After a lead service line is discovered? ☐ Yes ☐ No

At other times? Please specify: ☐ Yes ☐ No

If not done in the past, are you planning to provide filters in the future? ☐ Yes ☐ No

How many filter programs were initiated in your system?

What was the total cost of implementing a filter program in your water system?

Can you describe why your program started, how long did it last, and how/when did it end?

## FILTER SPECIFICATIONS

What type of water filter was distributed? ☐ Pitcher ☐ Faucet Mounted ☐ Under Sink

What was the total cost (per filter) of supplying water filters (i.e., filter, cartridges, and delivery cost combined)?

What type of filter (manufacturer, model number, etc.) is supplied?

How was the filter selected?

What is the typical cost of a filter?

How many replacement cartridges are provided per home?

What is the recommended cartridge replacement frequency?

What is the typical cost of a cartridge?

What issues did your system face when implementing water filter program?

How do you work with the customers around filter use? Do you provide additional instructions?

What unexpected costs did your system run into when implementing the water filter program?

## DISTRIBUTION

How were filters distributed?

| | | |
|---|---|---|
| Mailed | ☐ Yes | ☐ No |
| Door-to-door drop off | ☐ Yes | ☐ No |
| Communal pick-up location | ☐ Yes | ☐ No |

Other (Please specify) ☐ Yes ☐ No

What were the cost(s) of distributing water filters?

What were the costs associated with replacing damaged filters?

If filter was mailed, what were the costs associated with replacing missing filters?

How do you control who you are distributing filters to?

### TERMINATING PROGRAM

What is the typical approach used when terminating the filter program?

What challenges did you face when terminating the filter program? What was the response from your community? How did you overcome the challenges?

## Bottled Water Program

### PROGRAM BACKGROUND

Does your water system routinely provide bottled waters to customers;

After a full lead service line replacement? ☐ Yes ☐ No

After a partial lead service line replacement? ☐ Yes ☐ No

After a major disturbance? ☐ Yes ☐ No

After a lead service line is discovered? ☐ Yes ☐ No

At other times? Please specify: ☐ Yes ☐ No

If not done in the past, are you planning to provide bottle water in the future? ☐ Yes ☐ No

How many bottled water programs were initiated in your system?

What was the total cost of implementing a bottled water program in your water system?

Can you describe why your program started, how long did it last, and how/when did it end?

## BOTTLED WATER SPECIFICATIONS

What was the total cost of supplying bottled waters?

What is the typical cost of a case of water bottles?

What factors determine the amount of bottled water each household receives?

What is the typical number and size of bottles given per person?

What issues did your system face when implementing the bottled water program?

What unexpected costs did your system run into when implementing the bottled water program?

## DISTRIBUTION

How were bottled waters distributed?

| | | |
|---|---|---|
| Mailed | ☐ Yes | ☐ No |
| Door-to-door drop off | ☐ Yes | ☐ No |
| Communal pick-up location | ☐ Yes | ☐ No |
| Other (Please specify) | ☐ Yes | ☐ No |

What were the costs of distributing water bottles?

What were the costs associated with replacing damaged cases of water?

If bottles were mailed, what were the costs associated with replacing missing cases of water?

## TERMINATING PROGRAM

What is the typical approach used when terminating the bottled water program?

What challenges did you face when terminating the bottled water program? What was the response from your community? How did you overcome the challenges?

## ADDITIONAL QUESTIONS

Did your system do anything else besides bottled water or filters (i.e., water truck for larger volumes)?

# Appendix B-1

## Benton Harbor Case Study

# 1 System Background

The City of Benton Harbor's Public Water system supplies treated water from Lake Michigan to approximately 9,800 people in Berrien County, Michigan. In 2018, the system found 90$^{th}$ percentile tap samples to be above the lead action level (AL). As a result, in 2019 the United States Environmental Protection Agency (EPA) Region 5 Administrator mandated the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and Benton Harbor into an administrative consent order. As part of this mandate, Benton Harbor had to improve corrosion control treatment (CCT) and provide customers with ANSI/NSF 53 water filters. In October of 2021, an executive directive was passed by the state of Michigan following 6 consecutive periods of AL exceedances. This directed Michigan departments and agencies to aid Benton Harbor to immediately start providing the affected community with bottled water or ANSI/NSF 53 certified water filters, educational materials, and relaying of clear and up-to-date information to residents about work being done to reduce lead exposure. Further details on Benton Harbors action level exceedance (ALE) can be found on the EPA's site.[17] Bottled water and filter provisions are provided to all residents due to the system's history of ALE's, and service line material as 98% of the services were unknown, lead, or previously galvanized connected to lead in September 2021. As of June 2022, 66% of all lead service lines within Benton Harbor has been replaced and the city continues to distribute filters and bottled waters to customers within their system.[18] The specifications of Benton Harbor's filter program will be further explored in this document.

# 2 Filter Program

The City of Benton Harbor's filter program began in 2019 in which ANSI/NSF 53 certified filters were paid for by Michigan's Department of Health and Human Services (MDHHS) and the Berrien County Health Department (BCHD) distributed water filters to residents.[19] Therefore, Benton Harbor's filter program was made possible through local-state relationships. As of October 2021, Benton Harbor provides ANSI/NSF 53 certified water filters to all residents within their system. Filters are sent out to customers within 3 business days of a filter request. Filters are also dropped off door-to-door automatically after a full lead service line replacement, partial lead service line replacement, major disturbances during a meter replacement, and after a lead service line (LSL) is discovered.

[17] EPA (2021) Petition for Emergency Action under the Safe Drinking Water Act. https://www.epa.gov/system/files/documents/2021-11/benton-harbor-sdwa-petition_digital-version.pdf
[18] MDHHS (2022) 66% of City of Benton Harbor lead serve lines replaced. https://www.michigan.gov/mdhhs/inside-mdhhs/newsroom/2022/06/23/pipe-update#:~:text=%E2%80%93%20The%20City%20of%20Benton%20Harbor,replaced%20with%20new%20copper%20lines.
[19] EGLE (2021) EGLE Letter to State Senator McBroom. https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Multi-Division/Benton-Harbor/2021/Letter-2021-11-03-Senator-Ed-McBroom-Benton-Harbor.pdf?rev=c0076634ad7f41d0b76110780fd9302e&hash=41F5EA2F1F83A740422E10539DF66B83

# 2.1 Filter specifications

## 2.1.1 Filter Type

MDHHS has provided its Benton Harbor residence with a choice of NSF/ANSI 53 PUR pitcher filter or NSF/ANSI 42 & 53 PUR faucet mounted water filters. Due to 6 consecutive monitoring periods showing an ALE between 2019 and 2021, the EPA collaborated with MDHHS to conduct a filter study to help provide reassurance to Benton Harbor's community that the selected filters are effective in removing lead given the system's specific water chemistry as described in 2.1.2.[20] Through this study, MDHHS has provided Benton Harbor resident with PUR faucet mounted filters as they are NSF/ANSI 43 & 53 certified to remove Class I particulates and lead. PUR pitcher filters, which are NSF/ANSI 53 certified to remove lead, are also supplied to customer's that have kitchen faucet that cannot have a filter mounted to it or if a customer prefers a pitcher filter.

## 2.1.2 Filter Study

In 2021, three studies were conducted for three months by the EPA in partnership with MDHHS to better understand the Benton Harbor's drinking water. This included (1) a filter study to assess the performance of various filters its ability to reduce lead levels (2) a sequential study to determine the source of lead on a home's property (3) a particle study to assess the quantity of lead particles found in Benton Harbor's drinking water. This study sampled 230 homes with faucet and pitcher filters from the brands Brita, PUR, and Zero Water. Findings from the study showed (1) most filters successfully removed lead below the detection limit of 0.5 ppb when installed and used properly, (2) sampling identified lead to be present in plumbing between the tap and the service line, and (3) lead particles were found to be in larger clumps which will be easily removable by filters as opposed to extremely small nanoparticles of lead.

## 2.1.3 Replacement Cartridges

MDHHS provides each Benton Harbor resident with an additional two cartridges with each faucet mounted and pitcher filter. The PUR filter cartridges for the faucet mounted filters are to be replaced every 3 months or every 100 gallons of use. PUR filter cartridges for pitcher filters are to be replace every 2 months or every 40 gallons of use.

## 2.1.4 Filter Cost

The associated costs of each filter along with the cost of replacement cartridges are listed in Table 2-1.

[20] EPA (2022) Benton Harbor, Michigan, Drinking Water Study Results. https://www.epa.gov/mi/benton-harbor-michigan-drinking-water-study-results

*Table 2-1 Filter Cost*

| Filter Model | Cost |
|---|---|
| Faucet Mount (+2 replacement cartridges)* | $17.47 |
| Pitcher Filter (+2 replacement cartridges)* | $28.98 |
| Additional replacement cartridges (2 pack): Faucet Mount | $23.33 |
| Additional replacement cartridges (2 pack): Pitcher | $24.01 |

* Replacement cartridges come with the original packaging of the pitcher filter and faucet mounted filter

### 2.1.5 Instructions Provided to Customers

Instructions from the manufacturer along with instructions created by MDHHS, which details how to install and use the filters, are provided to each customer. MDHHS has also created instructions for the PUR faucet filter in Spanish along with two videos on how to install a PUR faucet mounted filter and how to replace a PUR faucet mounted filter. Residences are also provided with document instructions from MDHHS on how to clean their aerators every week and flush their taps if stagnant for more than 6 hours. Instructions on how to clean aerators are also available in Spanish and video format. Two weeks after a customer has received a filter, BCHD staff contacts each customer by phone to ensure that the filter was installed properly. As of May 2022, MDHHS has an on-call contract with Home Depot that branches off of the master contract the state of Michigan has with Home Depot. This on-call contract allows MDHHS to request Home Depot to send local plumbers to customers that need help installing their filters. In emergency cases, plumbers can be sent out to complete necessary repairs within 45 minutes of a request.

## 2.2 Filter Distribution

### 2.2.1 Distribution Method

Customers can receive their filters via mail, communal pick-up location, or door-to-door drop off. Each delivery method is further described below.

#### Mailing

Customers can fill out a form on Michigan's Lead Safe website for the City of Benton Harbor Water efforts to request a filter to be sent to their home within 3 business days of ordering. Residents can also call BCHD to have a filter to be sent to their home, in which residents can also request a specific type of filter if they choose to do so. It is worth noting that requesting a specific type of filter does not affect the length of time it takes for residents to receive a filter.

#### Communal Pick-up Location

Customers can pick up filters from two locations in Benton Harbor, one of which is located at the BCHD office, and the second at a health center that was initially established in 2020 to help manage COVID cases and improve

health access to the community. Residents can pick up a filter at either location during their respective hours of operations. To pick up a filter, an appointment and identification (ID) is not required. What is required is an address that is within Benton Harbor's service area as well as the name of the individual requesting the filter for record purposes. BCHD also hosts distribution events, between June 2022 to September 2022 once a week at a local farmers market, in which residents can pick up a filter and receive installation assistance.

#### Door-to-door drop off

Door-to-door drop off is available for homebound residents, those without transportation, or to those who may need special accommodations. Residence can call BCHD to arrange such deliveries.

### 2.2.2 Costs

Although MDHHS does not keep track of detailed program and general distribution costs, they have reported an unexpected cost of $10,000 to obtain a comprehensive list of addresses for the City of Benton Harbor residents. In addition, the ongoing costs and response to the filter program is shared by the City of Benton Harbor, BCHD, MDHHS, EGLE, and local community organizations.[21] Therefore, Benton Harbor's filter program costs are difficult to detail.

# 3 Bottled Water program

As of October 2021, Benton Harbor has provided free bottled water to all residents within the system. Information in this section on Benton Harbor's bottled water program was retrieved from online resources.

## 3.1 Bottled Water Specification

Benton Harbor did not have information available online on the quantity of water given to customers per week or the associated costs of a bottled water program.

## 3.2 Bottled Water Distribution

### 3.2.1 Distribution Method

Customers can receive bottled water from communal pick-up locations, or door-to-door drop off. Each distribution method is further discussed below.

[21] MDHHS (2022) Free, bottled water available for City of Benton Harbor residents at Boys & Girls Club and Southwest Community Action Agency. https://www.michigan.gov/mdhhs/inside-mdhhs/newsroom/2022/08/01/water-update

### Communal Pick-up Location

Customers can pick up bottled water from the Boys & Girls Club of Benton Harbor or the Southwest Michigan Community Action Agency (SMCAA). Both locations operate asynchronously so that one location is open every day of the week.

### Door-to-door drop off

Door-to-door drop off is available for homebound residents, those without transportation, or to those who may need special accommodations. Residence can call BCHD to arrange such deliveries.

## 3.2.2 Outreach

Outreach of the program is a collective effort between the City of Benton Harbor, EGLE, MDHHS, BCHD, United Way of Southwest Michigan, and SMCAA, and local churches.[22] Customer outreach is conducted through follow-up phone calls with customers after receiving a filter, development of educational materials in English and Spanish which are provided to customers online, at filter distribution locations, and distribution events. EGLE has also collaborated with MDHHS to form town hall meeting for residents, community leaders, and city officials both in-person and virtually.[19] EGLE also sends ALE notification letters to Benton Harbor residents, when such events occur, through press releases, social media posts, and/or broadcast media or local newspapers.

## 3.2.3 Challenges

### Community Trust

Benton Harbor implemented a filter program in 2019 due to a lead ALE in 2018. Due to a continued ALE between 2018 and 2021, Benton Harbor faced challenges with lack of trust from the community. A petition was submitted on behalf of the Benton Harbor community members, in which one of their requests was a filter study that showed the effectiveness of their filters given the system specific water chemistry. The filter study conducted by EPA and MDHHS showed that most samples were below the detection limit when filters were installed and used properly, which helped Benton Harbor improve community trust.

### Funding

MDHHS faces challenges with funding as Benton Harbor's current filter program is not a part of their annual cost, rather the costs are taken out of their personal Action Level Exceedance Program annualized general fund, as well as a general fund for response allocation for safe drinking water in Benton Harbor.

[22] SMCAA (2022) City of Benton Harbor Water Distribution. https://www.smcaa.com/bentonharborwater

# 4 Program Termination

Benton Harbor may only terminate their program once they receive a written notice from the EPA stating that Benton Harbor has satisfactorily demonstrated adherence to the terms of the administrative consent order and executive directive. As part of the administrative order, Benton Harbor must meet all lead and copper public education requirements. As part of the executive directive, Benton Harbor must leverage available state resources to replace all lead service lines in the City, provide free or low-cost lead-related health care, take appropriate action to assist homeowners in replacing their LSL's, conduct customer education, communicate to residents with clear and up-to-date information on lead data results, and provide free bottled water and filters until further notice.

# Appendix B-2

## Clarksburg Case Study

# 1 System Background

The Clarksburg Water Board (CWB) supplies treated water from the West Fork River to approximately 65,000 people (64,915) in Harrison County, West Virginia. In 2021, it was confirmed that three small children within the system had elevated blood levels. After further investigation, water sample results indicated that these three children's homes tested above the EPA's lead action level.[23] This chain of events prompted an Administrative Order from both the West Virginia Department of Health and Human Resources (WVDHHR) and EPA. CWB was tasked to immediately start providing water filters, and educational materials to those above the action level. Filters were hard to secure due to distribution issues, therefore, bottled water was provided for two weeks at the beginning of the program.

# 2 Filter Program

Certified water filters must be provided to customers after a full lead service line replacement, partial lead service line replacement, major disturbances such as during work orders, after an LSL is discovered, and if an unknown LSL exists, as per the administrative order. A service line inventory is used to determine if the customer is in an area that requires a filter. According to the database, CWB currently has 2,399 known LSL and 2,210 service lines with unknown material.

## 2.1 Filter specifications

### 2.1.1 Filter Type and Cost

Clarksburg provides the affected community with pitcher filters (Brita Monterey Pitcher, Model No. OB50). Brita was chosen based on product availability, filtration performance, and lifespan. The filters were initially picked based on information gathered when searching. EPA had CWB performed a filter test early 2022 to make sure they were performing as advertised. These filters are NSF certified to remove lead. The typical cost of each filter is $29.84, and each cartridge is $14.27. Including delivery, the total cost of providing a filter is $73.14 per customer. Two replacement cartridges are provided every six months or 120 gallons. The replacement cartridges are all hand delivered, there is no pick-up location. It would have cost about $16,000 more to mail them instead, for the postage alone. This way CWB can keep track of it easier and the staff earn overtime. The total cost as of June 2022 is $365,705, with $260,705 going towards the filter purchases and $105,000 going towards delivery.

### 2.1.2 Instructions Provided to Customers

Along with each filter, instructions from the manufacturer are provided to the customer detailing how to use and install the filter. Customers are instructed to replace their pitcher filter cartridge after 6 months or 120 gallons of use. Two replacement cartridges are provided each replacement period. Customers can also acquire filters

[23] CDC (2022) Information About Lead Exposure in Clarksburg, West Virginia. https://www.cdc.gov/nceh/lead/docs/lepac/info-lead-exposure-clarksburg-wv-may-2022-508.pdf

outside of the replacement period if they run out of filters. The pickup and delivery options remain the same for this. CWB does provide training when the customer picks up the filter from their location and supplies them with supplemental EPA instructions as well.

## 2.2 Filter Distribution

### 2.2.1 Delivery Method and Costs

Customers receive their filters through door-to-door drop-off or via a communal pick-up location. CWB stores and provides these filters from the treatment plant. There is no other pick-up locations for either filters or bottled water programs. A database is used to track who is given filters, what day they were delivered or picked-up, and when their filters expire. The locations are searched up in the database to verify that the house fits the required criteria. Roughly $115,000 was spent distributing the filters. Most of this expense was for the West Virginia Army National Guard (WVANG) who helped in the door-to-door distributions. The rest of the expense was employee overtime. Approximately $3,000 was spent replacing damaged filters.

An app “Go Canvas” will be used to allow CWB to keep track of everything. It will load all the data from their system and mark the customers as work orders. Once the staff has delivered the replacement cartridge, they are able to mark it as complete or add any complications that occurred. The software allows them to take a picture of the delivery, much like many delivery companies, for proof. The software also provides real time updates, allowing CWB to keep track of everything while deliveries are being made.

### 2.2.2 Unexpected Costs

This was an unexpected situation and therefore was not a budgeted expense. Money was pulled from the capital reserve to and funding was acquired from the Governor’s Office to help with the purchase of filters. CWB is hoping to start putting money back into the reserve after the program ends. They want to test the new CCT method before switching back to tap.

# 3 Bottled Water Program

Bottled water was distributing at the beginning of the of the filter program while the filter was still being secured. Once the filters were acquired, bottled water was handed out until none were left. The program lasted two weeks and there is no plan to use this program in the future.

## 3.1 Bottled Water specifications

### 3.1.1 Bottled Water Type and Cost

The amount of bottled water that was given to each customer was determined by the number of members living within the household. Distribution was based on eight 16.9 oz bottles person per household. A standard 40 bottle case was used for supply, with each case costing $3.98. The total cost of purchasing was $14,555. This means

that roughly 3,000 cases were used in the two-week period, with roughly 2,000 of those cases being supplied by the State of West Virginia. This program latest roughly two weeks and costed a total of $24,555.

### 3.1.2 Instructions Provided to Customers

No instructions were provided for the bottled water program.

## 3.2 Bottled Water Distribution

### 3.2.1 Delivery Method and Costs

Customers receive their bottled water through door-to-door drop-off or via a communal pick-up location. CWB stores and distribute the bottled water from their utility office. The same qualifications for the filters were used for the bottled water. CWB tracked determinations as to whether a customer qualified for provision. Approximately $10,000 was used to deliver the bottled water. The expense was split similarly to the filter program cost. Regarding the purchase of the water cases, only a portion of the cost was paid for by CWB ($1,355), the rest was paid for by the State of West Virginia ($13,200).

### 3.2.2 Unexpected Costs

The bottled water program was an unexpected cost and not included in CWB's budget. Due to the short duration (2 weeks) of this program and the aid received from the State of West Virginia, the bottled water delivery program represents a small portion of CWB's program expenses.

## 3.3 Termination

The current total cost is $380,260 as of June 2022, with $24,555 being used for the bottled water. Since this is an on-going program, the cost will continue to rise. Included in this total cost is $90,000 the State of WV has not yet billed CWB for assistance received from the Army National Guard. The bottled water program was terminated after two weeks. During this time period, CWB was able to secure enough filters to continue with their filter program. CWB made the customers aware that this would be temporary and therefore faced no challenges ending the program. EPA will inform CWB when they are able to end the filter program.

# 4 Challenges

When CWB first implemented their filter program, they faced challenges finding a supplier that could fulfill their demand needs. Once a supplier was selected, there were multiple delivery delays due to a shortage of truckers back in July 2021. Due to its weight, the bottled water required a forklift to efficiently move delivered water at the storage site, and more truck trips were needed compared to the filters delivering bottled water to the storage site. Existing facilities suitable for forklift operation were limited and did not allow for climate-controlled storage of bottled water.

There were also issues with the delivery of the bottled water. The delivery trucks had to keep reloading bottled water when out delivering due to the size and weight of the cases. Some customers were not home and were

unable to lift the cases without aid. This led to return visits to these homes to help move the water cases. The Army National Guard also didn't know the area very well. This led to the cases being delivered to the wrong locations and in some cases the wrong town. CWB received calls from homeowners in these towns, wondering why their neighbors got water but they didn't. CWB had to explain the mistake and had to make sure that the correct locations did get their water. Customers were taking advantage of the program by taking multiple cases. They would receive the cases through the door-to-door delivery and then go pick them up from the pick-up locations. It is estimated that some families got up to nine cases in a week. There is no documentation for this number since distribution at the begin of the program was largely accomplished through the Army National Guard.

# 5 Database

To assure reliable compliance with its consent agreement Clarksburg maintains an extensive tracking system that contains location lead results, service line material for both public and private, any lead line removals, any sampling done, how many cases of water were used for a home, how many filters and replacement cartridges were used for each home, when the cartridge needs to be replaced, as well as the results and trend of the filter program. They also track their filter inventory and sign-ups; filter instructions are taken care of during sign-up.

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