Vermont Lead in School and Child Care Drinking Water Progress Report

Findings from the First Round of Testing and Remediation

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DEPARTMENT OF HEALTH

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Contents

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Executive Summary

In 2019, the Vermont legislature passed Act 66, which requires all schools and child care providers to test every tap (outlet) "currently or reasonably expected to be used for drinking or cooking" for lead. Prior to the passage of this law there was no comprehensive requirement that schools and child care facilities test all of their drinking water taps for lead. The law established an action level of 4 parts per billion (ppb) for lead in water. If lead is found at or above the 4 ppb action level, the school or child care provider must immediately take the fixture out of service and take steps to eliminate or reduce the amount of lead to below 4 ppb. This report summarizes the results of the first round of testing which was completed on December 31, 2021.

In all, 98% of schools and 98% of non-school based child care facilities completed testing prior to December 31, 2021. Seventy-six percent of schools and 14% of non-school based child care facilities had at least one tap with lead levels at or above the action level of 4 ppb. Bottle fillers consistently had the lowest lead levels compared to other fixture types. Sinks were the most common tap tested and had among the highest lead levels (six sinks had results greater than 1,000 ppb, one exceeded 25,000 ppb). Lead results for individual schools and child care facilities are available on the results website.

The most common remediation actions were fixture replacement (54%), removal from service (16%), and point-of-use filter installation (8%). Of the schools with at least one tap at or above the action level, 54% completed remediation. Of the 131 child care facilities with at least one tap at or above the action level, 79% completed remediation. Ninety percent of the time, remediation costs were less than $500 per tap. Remediation efforts are ongoing and will be summarized in a later report.

Based on these results, recommendations include:

- Remove redundant or seldom-used fixtures.
- Encourage the use of bottle fill stations.
- Minimize reliance on labor-intensive flushing programs or point-of-use filters as long-term remediation strategies. Fixture removal, replacement or other remediation actions that permanently remove potential sources of lead exposure are preferable.
- Consider updating sampling guidance to give facilities flexibility in the timing of sample collection and to better understand the full range of lead levels.
- Develop and deploy a state-wide, centralized, online tap inventory management system to ease administrative burdens associated with future rounds of lead testing.

The Vermont Action Level of 4 pbb is lower and more protective than the federal law regulating lead in public drinking water. Most of the remediation actions reported included low-cost remediation actions like fixture removal, fixture replacement, and point-of-use filter

installation. Costly remediation actions, like plumbing replacement or bypass and service line replacements, were rare. Taps were successfully remediated to a lead level below 4 ppb for less than $500 per tap 90% of the time. Through concerted and coordinated state-wide effort, levels of lead in school and child care drinking water have been reduced well below the federal action level.

Background

Lead is a toxic metal that is harmful to human health. Lead can harm anyone, but children under the age of 6 are at special risk. Children are most susceptible to the effects of lead because their bodies are still developing, and they absorb lead more easily than adults do. Lead can affect children's development in many ways, but it can cause particular harm to the central nervous system (brain).

There is no safe level of lead in the body. Even low blood lead levels in a child's body can slow growth, make it hard to learn, and cause behavior problems. Most children who have lead poisoning or high levels of lead exposure do not look or act sick. The amount of lead in a child's body depends on several factors—including their exposure to lead, their age, their nutritional status, and other factors. In 2021, 387 children under 6 years old were poisoned by lead in Vermont. The effects of lead poisoning are irreversible, but it is entirely preventable. While a major source of lead poisoning in Vermont children is paint, lead in older plumbing and fixtures can add to a child's overall lead exposure.

Because there is no safe level of lead in the body, Vermont has set a health advisory level of 1 part per billion (ppb) in drinking water, which is the lowest level that can be detected in water. It is consistent with the American Academy of Pediatrics' recommendation that water sampled from taps in schools should not have lead levels above 1 ppb.

In spite of several legislative and regulatory efforts to remove lead from drinking water on both the state and federal level, lead may still be present in drinking water at a school or child care facility. Lead can get into drinking water as water moves through older lead pipes, plumbing fixtures or solder that contain varying levels of lead. The age of the facility's plumbing and plumbing fixtures is an important factor. Until as late as the 1980s, lead pipes were used for some service lines and connections that carry water from street mains to buildings. Lead-based solder containing as much as 50% lead was used to join standard copper water pipes until it was outlawed in 1988. However, solder could still be legally made up of 8% lead. In 2010, Vermont became one of the first states to further reduce the amount of lead in plumbing fixtures from 8% to 0.25%, and to 0.2% in solder and flux. As of 2010, non-compliant plumbing fixtures and supplies cannot be sold or installed in Vermont.

Prior to the passage of Act 66 in 2019, some schools were required to test some of their taps for lead, and all child care facilities were required to test one of their taps for lead as part of the licensure process. After the passage of Act 66, all schools and all child care facilities are

required to test all of their taps that are used for drinking or cooking for lead. In addition, Act 66 set a lower action level, 4 ppb, than prior testing requirements. Descriptions of three testing efforts that pre-date the passage of Act 66 are provided below.

First, under the federal Lead and Copper Rule (LCR), some schools are required to test for lead in drinking water. Schools on their own well that serve at least 25 people are considered a public water system and are required to test for lead under the LCR. The LCR prescribes the number of samples and frequency of sampling, but it does not require sampling at every fixture used for consumption. Schools on their own well that serve fewer than 25 people and schools that get their water from a public water system (town, city or other) are not required to do any lead testing under the LCR. One shortcoming of this approach is that, even when water entering the building contains no detectable lead, lead may be introduced as the water flows through and sits in the school's pipes, fittings, and fixtures, if they contain lead.

Second, child care providers were required to test for lead in water at their facilities starting in 2016. Only one first draw sample was required to be collected from one tap. No further action was required if the first draw lead result was less than 15 ppb. This testing requirement has been updated to meet the requirements of Act 66.

Third, the Health Department, Department of Environmental Conservation and the Agency of Education led a joint pilot project from November 2017 to March 2018 to gather information about lead levels in Vermont schools. This project provided 16 schools with the opportunity to receive one-on-one assistance and offered testing supplies, analysis and follow-up testing free of charge to participating schools. If lead was found in drinking water, state agencies and drinking water experts worked with schools to find the best possible solution to lower lead levels. In every school tested in the pilot project, lead was found at levels that exceeded 1 ppb, the Vermont Health Advisory Level and the recommendation of the American Academy of Pediatrics.

Building on the pilot project, Act 66 (2019) requires all Vermont school districts, supervisory unions, independent schools and child care providers to test their drinking and cooking water for lead. If lead is found in an amount at or above the action level of 4 ppb, the school or child care provider must immediately take the fixture out of service and take steps to eliminate or reduce the amount of lead to below 4 ppb. Money was appropriated by the legislature to pay for testing and to reimburse schools and child care providers for the cost of fixture replacement.

Implementation

The implementation of Act 66 built on the processes developed for the 2017-18 pilot project. The major steps of the process followed by schools and child care providers are described below.

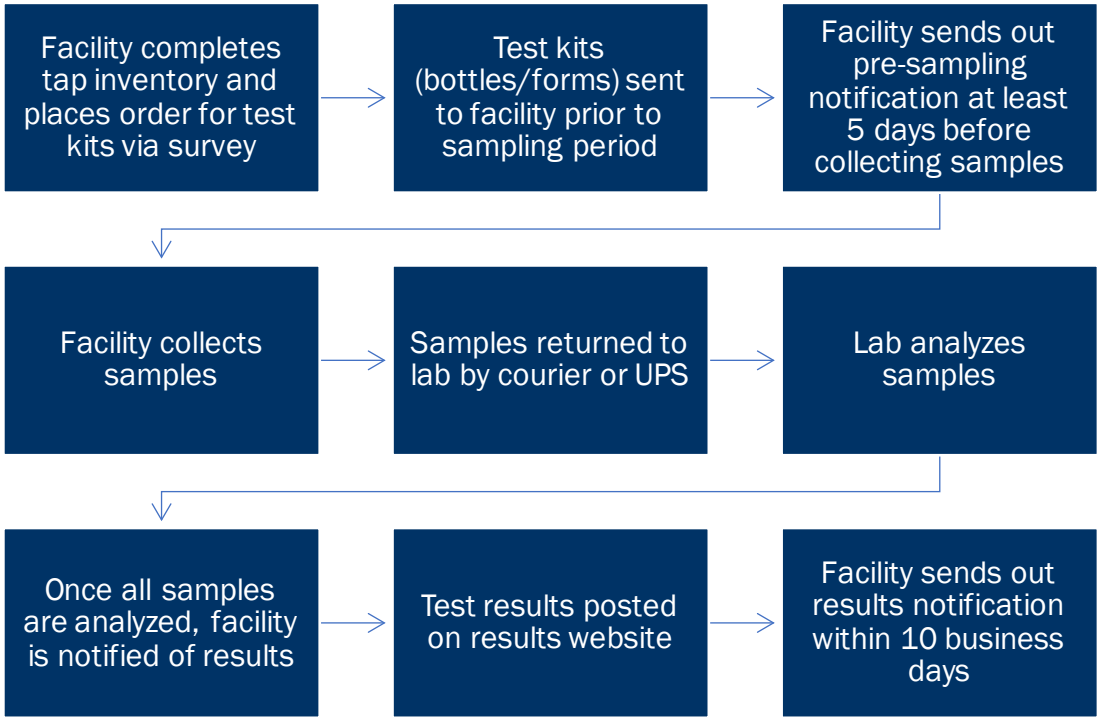

Figure 1. Process for testing drinking water for lead in school and child care facilities. Child care business technicians from the Child Development Division of the Department for Children and Families assisted non-school based child care providers with tap inventory completion and ordering test kits.

Resources and Training

Resources were created to share the requirements of the law with a variety of audiences. For schools and child care providers, separate web pages with step-by-step instructions were developed. Additional resources such as guidance documents, templates, FAQs, and tutorial videos were also developed to help them through the process. Web pages were also created for parents, caregivers and staff, which contains information on the basic details of Act 66, what to expect from their school or child care provider, and other potential sources of lead exposure.

To implement this complex process quickly, a variety of trainings were developed and delivered. Trainings specific to processes for creating a tap inventory, ordering test kits, collecting samples and reporting remediation actions were provided to school facilities managers and child care business technicians. The Health Department anticipated receiving many questions about the law and contracted with the statewide information and referral helpline, Vermont 2-1-1, to provide call center resources. In order to prepare 2-1-1 to receive, answer and triage calls, trainings about Act 66, the requirements and the processes were also provided to 2-1-1 staff.

Tap Inventory

Schools were asked to submit an inventory of every tap in their facility "currently or reasonably expected to be used for drinking or cooking." A tap is where the water comes out and from where water samples were taken. To simplify the sampling process, schools were asked to identify and test any taps in rooms used or operated by child care providers within their facility.

Child care business technicians from the Child Development Division of the Department for Children and Families assisted non-school based child care providers with development of their tap inventories. Child care providers were called by child care business technicians in alphabetical order, starting with non-school based programs that operate year-round, followed by programs that operate seasonally or only during the school year.

Materials and resources were developed to help schools and child care providers develop their tap inventories. A resource with photos of fixture types helped schools and child care providers identify their taps. A video tutorial helped schools and child care providers fill out the tap inventory template.

Scheduling

Once tap inventories were submitted, reviewed and approved, schools and child care facilities were scheduled for sampling.

To create efficient routes for sample pickup, public schools were scheduled by supervisory district and independent schools were scheduled according to their geographic location. Schools were assigned a week-long sample collection window and were asked to collect their samples within that time period. School drinking water samples were picked up by a courier at the end of the sample collection week and delivered to the lab. The Health Department sent schools an email indicating their sample collection week at least six to eight weeks in advance.

Existing child care providers were scheduled as tap inventories and contact information were collected. New applicants and child care programs that operate seasonally were prioritized for scheduling. Child care providers were asked to collect samples within one week of receiving the test kits in the mail.

Pre-sampling Notification

Schools and child care providers were required to notify parents, caregivers and staff about the drinking water sampling at least five days before collecting the samples. The notification included the dates the samples would be collected, why they are testing for lead, and how the community would be notified about the results. The Health Department provided a letter template and an informational sheet for this notification as well as translations of both documents for limited English populations.

Sample Collection

Test kits were sent by mail to schools two to four weeks prior to their sample collection window. Test kits were sent to child care providers as they were scheduled. In addition to pre-labeled sample bottles for each tap listed on a tap inventory, these kits contained:

- instructions on how to collect water samples,
- a Water Sample Worksheet to document the date and time that each sample was collected, and
- a pre-paid return shipping label or information about how to schedule a pickup using the Health Department's courier service.

First draw and flush samples were collected from drinking water taps. The first draw sample collects the first water that comes out of the tap after a period of inactivity, typically between eight and 18 hours. The flush sample collects water after the tap has been running for 30 seconds. The flush sample helps determine where lead may be coming from (for example, plumbing fixtures versus pipes). A high lead result in a first draw sample typically indicates that plumbing fixtures are likely the source of lead. If the flush sample yields a high lead result, then it likely means the lead is coming from the pipes and/or solder. If lead levels in both the first draw and the flush samples are elevated, multiple remediation strategies could be pursued.

A first draw and a flush sample were collected from most taps. Fixtures that have multiple taps, such as a sink with a faucet and a drinking fountain or bottle fill station and drinking fountain, are called "combo fixtures." For combo fixtures, two first draw samples were collected, but only one flush sample was collected since both taps draw from the same water pipe. For ice machines, a first draw sample was collected by melting ice. No flush sample was collected. See photo examples of different types of fixtures.

Samples were collected first thing in the morning before water was used in the building. Sometimes it took multiple days of sampling to complete sample collection in larger school buildings with multiple floors. Samples were collected on any morning following a typical school or business day. School staff and child care providers were asked not to collect samples the first day back after a weekend, holiday or vacation since water would have sitting in the pipes for more than 18 hours.

Laboratory Analysis

Samples were collected in wide-mouth, 250 milliliter (8 ounce) plastic bottles. Samples were analyzed by the Vermont Department of Health Laboratory or Endyne, Inc. Upon receipt, samples were preserved with nitric acid to reduce the pH below 2. Samples were also screened for turbidity (cloudiness) prior to analysis by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS). Any sample that had a high turbidity reading was acid digested. Both labs used EPA Standard Method 200.8 (ICP-MS) to analyze for lead. For quality assurance, 10% of the samples were analyzed in duplicate. Similarly, 10% of samples were evaluated for interference from the

sample (matrix effects) by adding a known amount of lead and checking for a suitable recovery of the analyte.

Results Notification

School administrators and child care providers were notified of their results by email. Shorter turnaround times of four to eight weeks were typical, with longer turnaround times of up to 12 weeks occurring during COVID-19 outbreaks and times of peak laboratory activity. All results were made available to the public on the Lead in School and Child Care Drinking Water Results Website one week after they were sent to school administrators and child care providers.

Schools and child care providers were required to send a notification to parents, caregivers and staff of the results within 10 business days of receiving their results. This notification included a summary of the drinking water testing results, instructions for how to access the full results, what immediate actions were taken to remove taps used for cooking and drinking that were at or above the action level, and what permanent remediation actions were planned. The Health Department provided a template and translations for results notification.

Remediation

When lead levels were found at or above the action level of 4 ppb, schools and child care providers were required to immediately stop using that tap for drinking or cooking. Schools and child care providers submitted immediate, planned and permanent remediation actions using an online form. Remediation actions were displayed on the results website alongside testing results for each tap. The Department of Environmental Conservation provided technical assistance for remediation efforts. Child care business technicians from the Child Development Division of the Department for Children and Families assisted child care providers with reporting of remediation actions.

Possible immediate remediation actions included removal from service, posting a "Do Not Drink" or "For Handwashing Only" sign, and installing a point-of-use filter after consulting with the Department of Environmental Conservation. Possible permanent remediation actions included fixture removal, fixture replacement, point-of-use fixture installation, internal plumbing replacement or bypass, service line replacement, automatic flushing device installation, and treatment installation or optimization. (A fixture includes the tap and the associated pipes and valves.)

Follow-up Testing

All remediated taps required follow-up testing before they could be returned to service. Remediated taps were flushed for five minutes twice a day for at least three weeks before and until completing follow-up testing. After receiving a follow-up result below 4 ppb, a tap could be returned to service.

Reimbursement

The cost of fixture replacement was reimbursable. Schools and child care providers were encouraged to submit remediation costs, both parts and labor, to the Health Department for reimbursement. The maximum allowable reimbursement amounts depending on the fixture type were:

- Public drinking fountains and ice machines: $1,800
- Taps used for cooking: $650
- All other taps
    - in schools: $350
    - in child cares: $400

Timeline

Act 66 (§1243e) specifies that any school or child care that completed lead testing of their facility's drinking water fixtures on or after November 1, 2017 would be considered to have met the initial testing requirements of this law. This included those schools that tested as part of the Health Department's 2017-18 pilot program. A small number of schools also tested during the spring of 2019 while Act 66 was still under consideration by the legislature.

Act 66 was passed in June of 2019. More than 250 schools completed their initial sampling before schools closed in March 2020 due to the COVID-19 pandemic. Since water samples need to be collected when the schools are under normal operation, sample collection stopped when the schools closed. Pandemic response also impacted the Vermont Department of Health Laboratory, which stopped analyzing water samples to focus efforts on increasing COVID-19 testing capacity. As a result, analysis of drinking water samples for lead shifted to a private certified drinking water laboratory which the Health Department had on contract to provide additional lab capacity. As a result of the pandemic-related school and child care closures, the deadline to complete initial testing was extended from December 31, 2020 to December 31, 2021.

Testing Results

Many of the findings described in this section were based on results available on the results website through Jan 21, 2022 or later as indicated.[1]

Almost all schools and child care facilities (98%) completed initial testing prior to the December 31, 2021 deadline.

[1] Results through Jan 21, 2022 include all schools and child care facilities tested by the Round 1 testing deadline of December 31, 2021.

- Out of 424 schools that required testing, 416 (98%) completed testing. An additional 35 schools did not require testing because they were closed, exempt (for example, do not have any taps to test), postponed due to construction, or were part of another school that already completed testing on their behalf.
- Out of 770 licensed child care facilities that required testing, 751 (98%) completed testing.

One out of five taps tested had initial results at or above the action level of 4 ppb.

- A total of 15,366 taps were tested in schools and child care facilities. Of those, 3,025 taps (20%) had initial results at or above the action level (Figure 2).

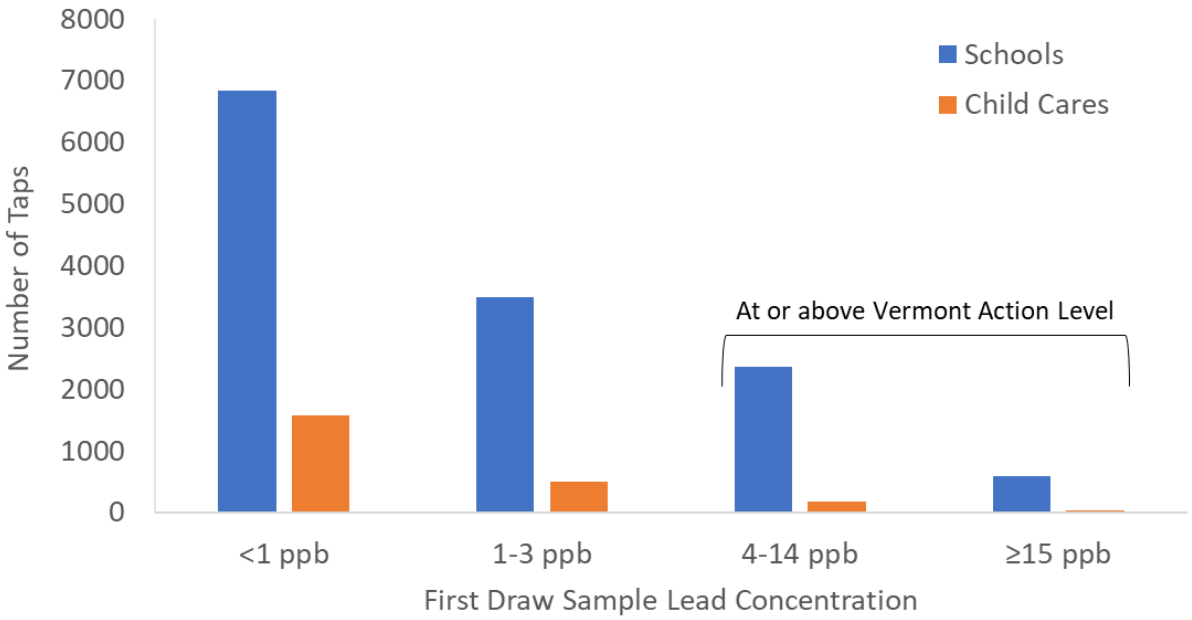

Figure 2. Frequency of taps with first draw samples at different lead concentrations as of February 2, 2022.

Most taps had results below the health advisory level of 1 ppb.

- 8,411 (54%) of all taps had lead results below the health advisory level of 1 ppb.
- 3977 (26%) of all taps had lead results above the health advisory level (1 ppb) and below the action level of 4 ppb.

Taps in schools were twice as likely to require remediation than taps in child care facilities. Schools were five times more likely than child care facilities to have at least one tap at or above the action level of 4 ppb.

- In schools, 21% of taps had initial results at or above the action level. Most schools tested (76%) had at least one tap at or above the action level. The maximum number of taps at a school was 178 taps. The median number of taps per school was 24 taps.
- In child care facilities, 9% of taps had initial results at or above the action level. A smaller percentage of child care facilities (14%) had at least one tap at or above action level. The maximum number of taps at a child care was 24 taps. The median number of taps per child care was 2 taps.
- Since schools generally have more taps than child care facilities, they were more likely to find at least one tap with an elevated lead level.
- Schools often have longer periods of time when water is not used, have more extensive plumbing networks, and may also have older fixtures and plumbing components. These factors can increase the likelihood of finding lead in drinking water.

Sinks were the most common type of tap tested.

- Among the different types of taps tested in both schools and non-school based child care facilities, sinks were the most common (10,423 tested), followed by drinking fountains (3,622 tested), and bottle fillers (952 tested).
- Other types of taps such as kitchen kettles, pot fillers and refrigerator dispensers were less common.

Sinks had higher lead levels, and bottle fillers had lower lead levels, compared to other types of taps.

- Sinks, on their own or as a component of a combo fixture, had among the highest lead concentrations (Figure 3).
- In contrast, bottle fillers, on their own or as a component of a combo fixture, had the lowest lead levels.
- The lead levels found in drinking fountains were in between the lead levels found in sinks and bottle fillers.
- In both schools and child care facilities, the percentage of sinks at or above the action level of 4 ppb or at or above the health advisory level of 1 ppb was higher than the percent exceedances for drinking fountains and bottle fillers (Table 1). These patterns were found for both schools and non-school based child care facilities. However, the average and range of lead levels for these taps differed between schools and child care facilities (Table 1), with higher maximum lead concentrations found in schools compared to child care facilities for each type of tap.

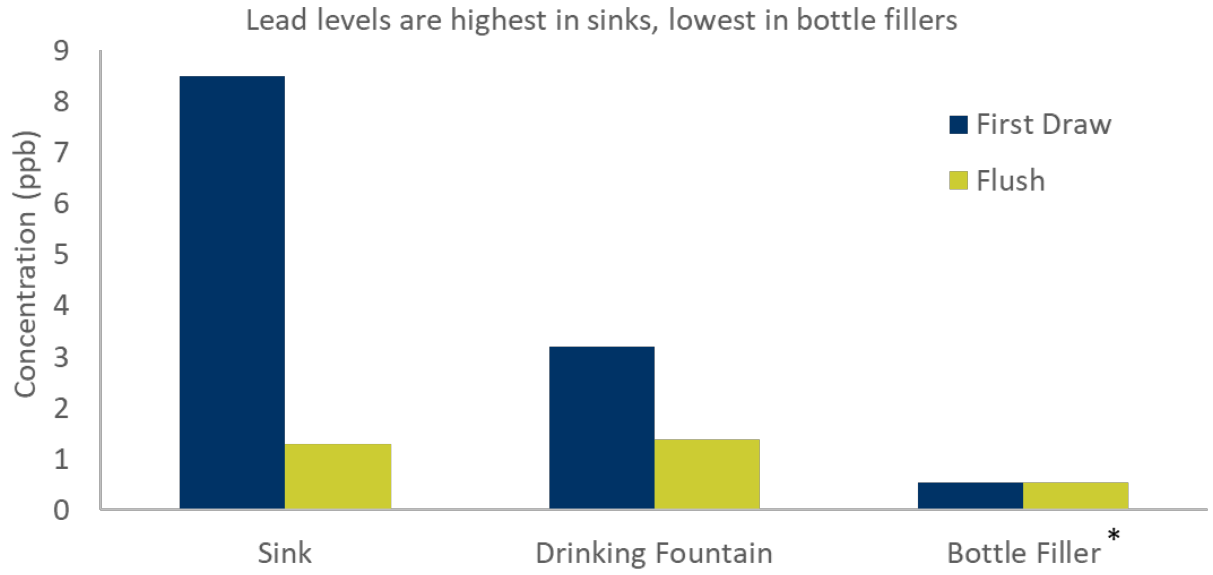

Figure 3. Average lead concentrations in first draw and flush samples for the most common types of taps in schools and non-school based child care facilities. *To calculate averages, a value of 0.5 ppb was assigned to all results that were below the detection limit of 1 ppb.[2] The average result was below 1 ppb for bottle filler first draw and flush samples.

First draw samples often had higher lead levels than flush samples.

- Sinks and drinking fountains had higher average and maximum lead levels in first draw samples compared to flush samples (Figure 3, Table 1).
- In contrast, both first draw and flush samples from bottle fillers had similarly low lead levels.

Sinks were the largest potential source of exposure to lead in drinking water.

- Sinks were the most common type of fixture and were found to have higher lead concentrations on average than other types of fixtures in both schools and child care facilities (Figure 3, Table 1).
- Sinks may have higher levels of lead because they are older or infrequently used.
- In contrast, bottle fillers were found to have lower lead concentrations on average than other types of fixtures in both schools and child care facilities. The newer components in

[2] To include sample results that were below detection limit in calculations such as averages, a value that is below detection limit can be assigned to such results, as in Clarke, J.U. (1998). Evaluation of censored data methods to allow statistical comparisons among very small samples with below detection limit observations. Environ. Sci. Technol., 32, 177–183.

bottle fillers contain less lead, and many have integrated filters that can help remove lead from drinking water.

Table 1. Summary of lead concentrations from initial testing of the most common taps in schools and non-school based child care facilities.

			Average (ppb)*	Maximum (ppb)*	Number of Samples	At or above 4 ppb	At or above 1 ppb
Schools	Sinks	First Draw	10	25,140	8,420	27%	59%
		Flush	1	784	8,077	5%	58%
	Drinking Fountains	First Draw	3	871	3,526	17%	35%
		Flush	1	518	1,740	4%	29%
	Bottle Fillers	First Draw	<1	5	902	<1%	3%
		Flush	<1	4	412	<1%	4%
Child Care Facilities	Sinks	First Draw	2	346	2,003	10%	34%
		Flush	<1	23	1,813	2%	35%
	Drinking Fountains	First Draw	1	13	96	9%	17%
		Flush	<1	15	77	5%	13%
	Bottle Fillers	First Draw	<1	4	50	2%	4%
		Flush	<1	1	38	0%	3%

** To calculate averages and percent exceedances, a value of 0.5 ppb was assigned to all results that were below the detection limit of 1 ppb.[2] Minimum lead concentrations were < 1 ppb (below detection limit) for first draw and flush samples for each tap type shown.*

Remediation Results

Many schools and child care providers are still in the process of remediating taps. The following reflects remediation actions reported as of February 17, 2022. Schools and child care providers are required to complete and report permanent remediation actions for all taps with a lead level at or above 4 ppb within 18 months of receiving results. Options for remediation actions are summarized in Table 2.

Of the schools with at least one tap at or above the action level, 54% have successfully completed remediation.

- Of the 416 schools that completed initial testing, 314 schools had at least one tap with a result at or above the action level.
- Of these 314 schools, 171 (54%) were able to successfully remediate, either by simply removing a fixture or fixtures from service (68 schools), or by completing other remediation actions and conducting follow-up testing that showed lead levels now below the action level for all fixtures (103 schools).

- The remaining 143 schools (46% of schools with at least one tap at or above the action level) are in the process of completing remediation actions or conducting follow-up testing.

Of the child care facilities with at least one tap at or above the action level, 79% have successfully completed remediation.

- There were 131 child care facilities with at least one tap with a result at or above the action level.
- Of these, 103 (79%) were able to remediate either by removing a fixture or fixtures from service (60 child care facilities), or by completing remediation actions and conducting follow-up testing that then showed lead levels below the action level for all fixtures (43 child care facilities).
- The remaining 28 child care facilities (21% of child care facilities with at least one tap at or above the action level) are in the process of completing remediation actions or conducting follow-up testing.

Table 1. Summary of permanent remediation actions taken by schools and child care facilities.*

Permanent Remediation Action	Number of taps	Percentage of taps with a permanent remediation action
Fixture replacement	1,321	63%
Permanently removed from service	413	20%
Point-of-use filter installed	228	11%
Internal plumbing replacement or bypass	85	4%
Permanently removed from service and installed a new fixture in a new location (for example, centrally located bottle fill station)	29	1%
Service line replacement	5	<1%
Treatment installation/optimization	0	0%
Automatic flushing device installation	0	0%
TOTAL	2,081	100%

*As of March 22, 2022. Remediation actions are self-reported by schools.

Remediation Costs

The following remediation costs results are as of February 8, 2022.

Remediation costs were less than $500 per tap 90% of the time.

- Remediation costs submitted for reimbursement requests ranged from $15 to $3,469 per tap (Figure 4).

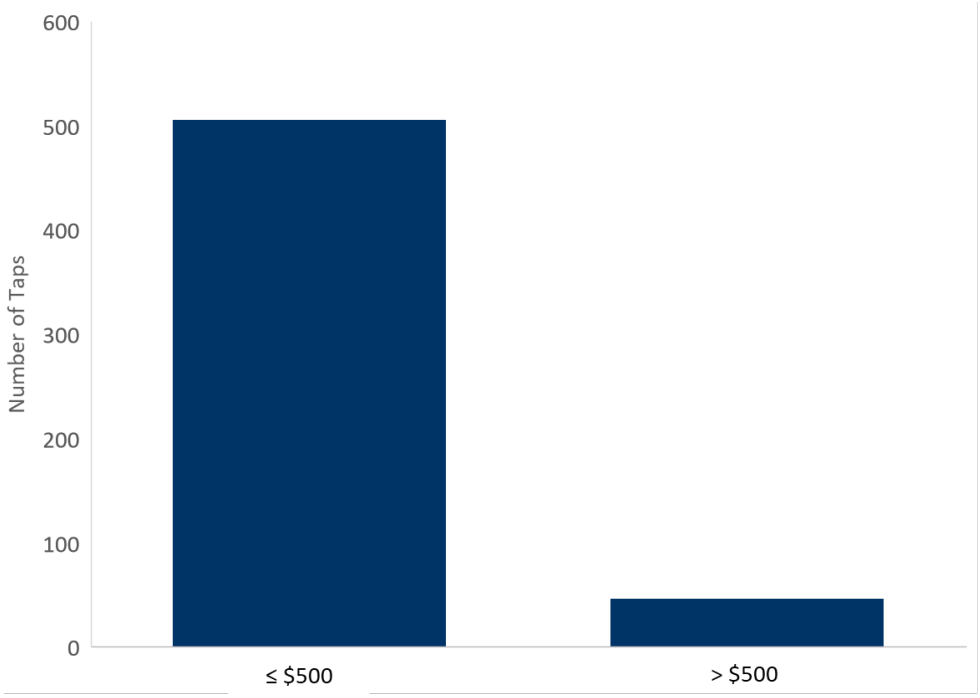

Figure 4. Distribution of remediation costs per tap based on reimbursement requests.

- Over $220,045 in remediation reimbursement requests have been processed.
- Reimbursement requests were lower for non-school based child care providers than schools, consistent with child care facilities having fewer taps than schools. The average reimbursement request was $452 for child care providers and $2,688 for schools.

Many schools and child care providers are eligible for remediation reimbursement but have not submitted reimbursement requests yet.

- For schools with results, 247 have reported reimbursable permanent remediation actions (Table 3). However, only an estimated 79 schools (32%) have requested and received reimbursement for their remediation actions.
- For child care providers, 69 have reported reimbursable permanent remediation actions, but only 17 child care providers (25%) have requested and received reimbursement.
- An estimated 168 schools and 44 non-school based child care providers remain that are eligible for remediation reimbursement but have not yet submitted a request. Some of these facilities may still be in the process of completing their remediation actions and conducting follow up testing. In some cases, facilities that have remediated their taps may have follow-up testing results that show lead levels that are still at or above action level and need additional rounds of remediation and follow-up testing.

Table 3. Summary of processed or anticipated reimbursements for schools and non-school based child care providers with reported results.

	Number with reimbursable remediations	Number (%) with processed reimbursements	Anticipated number remaining to be reimbursed
Schools	247	79 (32%)	168
Child Care Providers	69	17 (25%)	44
Total	**316**	**96**	**212**

Lessons Learned

Bulk processing of samples saved time and reduced errors. At the beginning of the project, every drinking water sample was accompanied by a sample collection form. This sample collection form required the person collecting samples to fill out information about the school or child care provider, the contact information of the sample collector, and the tap name that had already been collected in the tap inventory. This process of re-writing information that had already been collected was a waste of time for the person collecting the samples (some schools collected more than 100 samples). It also was a source of error and confusion when a different or incomplete name was provided for a tap on the sample collection form than had been provided on the tap inventory.

This process was improved when the project started using the tap inventory as the basis for the sample collection worksheet, which was provided with the sample collection kits and contained information about all their taps on one form. Under this process, only the time and date of sample collection needed to be recorded for each sample at the time of sample collection, which eliminated discrepancies between the tap inventories and the testing results.

A tap inventory management system would further reduce duplication and errors. Tap inventories were collected from schools and child care providers as a printable Excel spreadsheet file. This file was used by Health Department staff to generate the order for test kits. Using an electronic file for hundreds of schools and child care providers created issues with file management and versioning. If schools or child care providers want to amend or update their tap inventory, those changes cannot be made easily to the file on record.

To help address this issue, the Health Department and the Department of Environmental Conservation are planning to develop a centralized online Tap Inventory Management System (TIMS) to house tap inventories for schools and child care providers. Development of a centralized TIMS will also make it easier to incorporate additional certified drinking water laboratories into the testing process. This is because tap descriptions, along with school and child care information, can be stored in TIMS instead of having to be entered when each sample is processed at the laboratory.

An easy to use, publicly available results website provided transparency in communicating results. Development of a publicly accessible results website was one of the requirements of Act 66 (§ 1245b). The results website was designed to make it easy for parents, caregivers, staff, and school administrators and child care providers to quickly look up the lead testing results for their facility or their child's classroom. The site is easy to access on both computers and mobile devices. Testing results for each facility can be viewed or downloaded. The site provides summaries for each facility showing the number of taps that were tested, above the action level, successfully remediated, and the number of taps that still need to be fixed. The site also provides an overall summary with real-time information about the number of facilities that have completed testing and what percentage of taps were at or above the action level. A central location for storing lead testing results and showing each facility's progress helped ensure that everyone had access to important information and avoided unnecessary confusion or anxiety.

Successful implementation of a statewide lead testing and remediation program required an extraordinary level of collaboration. Representatives from state agencies met weekly, and daily at times, for almost a year to build the essential components of a statewide testing system. These state agencies included the:

- Department of Health Laboratory and the Division of Environmental Health
- Department of Environmental Conservation's Drinking Water and Groundwater Protection Division
- Department for Children and Families' Child Development Division
- Agency of Education's Communications and Policy Office

The state agencies sought input from school stakeholders to ensure that any implementation steps and communication efforts made sense. These stakeholders included the:

- Vermont Superintendents Association
- Vermont School Boards Association
- Vermont School Boards Insurance Trust
- Vermont School Custodians and Maintenance Association
- Vermont Independent Schools Association

Staff from schools and child care programs, Vermont 2-1-1, couriers and laboratories all played a role in the successful completion of this testing and remediation program. Child care providers and school facility managers learned how to collect samples and fill out necessary paperwork, dedicated hours to collecting samples before opening for the day, developed remediation plans, purchased and replaced fixtures, and completed follow-up testing. The State's shipping courier picked up tens of thousands of water samples from all over the state and transported them to the laboratory regardless of weather, on time and in good condition. When the Vermont Department of Health Laboratory could not process drinking water samples due to the demands of COVID-19 testing, a certified private drinking water laboratory stepped

in to provide that service. All these collaborative and coordinated efforts were necessary to identify and remove lead from drinking water in schools and child care facilities.

Recommendations

Remove redundant or seldom-used fixtures. Many facilities had sinks and/or drinking water fountains in every room. Some rooms even had several sinks within the room, not all of which were used on a regular basis but were available to be used for drinking water at any time. Lead levels in drinking water can increase as the water sits in the pipes and fixtures. Removing fixtures that are redundant or seldomly used for drinking water reduces potential exposure to lead in drinking water.

Permanently remediate fixtures. Do not rely solely on flushing programs or filters. Fixtures should be permanently removed from service or permanently remediated to reduce lead exposure. Despite the lower percentage of flush samples at or above 4 ppb compared to first draw samples (Table 2), flushing programs are not recommended because they rely on staff to follow a comprehensive flushing schedule consistently and indefinitely. While implementing a comprehensive flushing protocol is good practice for maintenance, it is labor intensive and should not be relied upon as a form of remediation. Also, the required frequency of flushing needed to keep lead levels below 4 ppb all day is unknown. After flushing, lead levels can increase over time if water is not used.

Point-of-use filters rely on staff to follow manufacturer recommendations for maintenance, also indefinitely. If proper maintenance is not performed, a point-of-use filter will not be effective at removing lead. In some cases, unmaintained filters can even make water quality worse. Point-of-use filters should only be installed after consultation with the Department of Environmental Conservation. Manufacturer recommendations for maintenance should be followed and logs should be kept to document filter changes.

Encourage use of bottle fill stations. Facilities that already have bottle fill stations should encourage their use. Facilities that do not have bottle fill stations should remove old or redundant classroom and hallway fixtures and install centrally located bottle fill stations equipped with appropriate filters. Manufacturer recommendations for maintenance should be followed and logs should be kept to document filter changes

Consider updating sampling guidance to give facilities flexibility in the timing of sample collection and to better understand the full range of lead levels. Current Health Department guidance says that water should not be allowed to sit in pipes and fixtures for more than 18 hours prior to sampling, and that schools should not sample after weekends or vacations. This guidance is consistent with the U.S. EPA's 3Ts Manual for Reducing Lead in Drinking Water in Schools and Child Care Facilities. Water that sits in lead plumbing and fixtures for longer periods of time, like over the weekend, will contain higher levels of lead. As a result, lead concentrations are likely higher on Monday morning and may not reflect average conditions.

The Health Department's guidance could be updated to allow sampling after weekends in order to better understand the full range potential lead hazards.

Conclusion

Levels of lead in drinking water can be reduced well below the federal action level. The EPA action level for lead in public drinking water systems is 15 ppb based on the 90th percentile of samples collected. Taps in schools and child care facilities were generally able to meet the Vermont's action level of 4 ppb. Most of the remediation actions reported included low-cost remediation actions like fixture removal, fixture replacement and point-of-use filter installation. Costly remediation actions like plumbing replacement or bypass and service line replacements were rarely needed. Taps were successfully remediated to a lead level below 4 ppb for less than $500 per tap 90% of the time.

Next Steps

Almost all schools and child care facilities successfully collected their initial samples for lead in drinking water. Despite these efforts, there are still steps to be taken to make sure that children are not exposed to lead in water at schools and child care facilities.

A small number of schools and child care facilities still need to collect their initial samples. The Health Department will continue to work with these remaining schools and child care providers to help them complete initial sampling.

Any tap with a result at or above 4 ppb needs to be permanently remediated. If the permanent remediation action is anything other than permanently removing the fixture, schools and child care facilities need to do follow-up testing to make sure that the fix lowered the lead levels to below 4 ppb. Schools and child care facilities need to report permanent remediation actions within 18 months of receiving results with a lead level at or above 4 ppb according to the rule. Many schools and child care facilities are in the process of remediation and follow-up testing. The Health Department and the Department of Environmental Conservation will continue to work with schools and child care providers to help them successfully complete required remediation and follow-up testing.

Some initial remediation efforts were not successful and required multiple remediation actions to get a lead level below 4 ppb. The Health Department will review these efforts to understand how many and why certain initial remediation efforts failed. This may help guide remediation recommendations for future rounds of testing.

Ongoing testing of lead in water at schools and child care facilities is required. Taps will need to be tested again in three years according to the schedule in the rule. The Health Department and the Department of Environmental Conservation will continue to provide technical assistance to schools and child care providers during ongoing testing and remediation efforts.

To prepare for the ongoing testing, administrative processes and systems need to be developed and improved. This includes updating guidance material, communicating with schools and child care providers about the ongoing testing requirements, orientating certified drinking water laboratories, and developing a tap inventory management system. A tap inventory management system will allow schools and child care providers to maintain an inventory of their taps online and order test kits from the certified drinking water laboratory of their choice. The next round of testing will begin as early as summer 2022.

This report will be updated as more information becomes available. Expected updates include details on remediation efforts and follow-up testing, remediation costs and remediation effectiveness.

Resources

- 3Ts Manual for Reducing Lead in Drinking Water in Schools and Child Care Facilities
- Act 66
- American Academy of Pediatrics Policy Statement: Prevention of Childhood Lead Toxicity
- "Do Not Drink" and "For Handwashing Only" signs
- Informational Sheet: Lead Poisoning in Children
- Instructions on How to Collect Water Samples
- Lead in School and Child Care Drinking Water Results Website
- Notification Letter Templates
- Photo Examples of Different Fixture Types
- Remediation Action Online Form
- Remediation Guidance for Schools with Results at or above 4 ppb
- Rule Governing Testing and Remediation of Lead in the Drinking Water of Schools and Child Care Facilities
- School Lead Testing Schedule
- Translated Materials
- Vermont Lead in School Drinking Water Testing Pilot Report
- Video Tutorial: How to Complete Your Tap Inventory