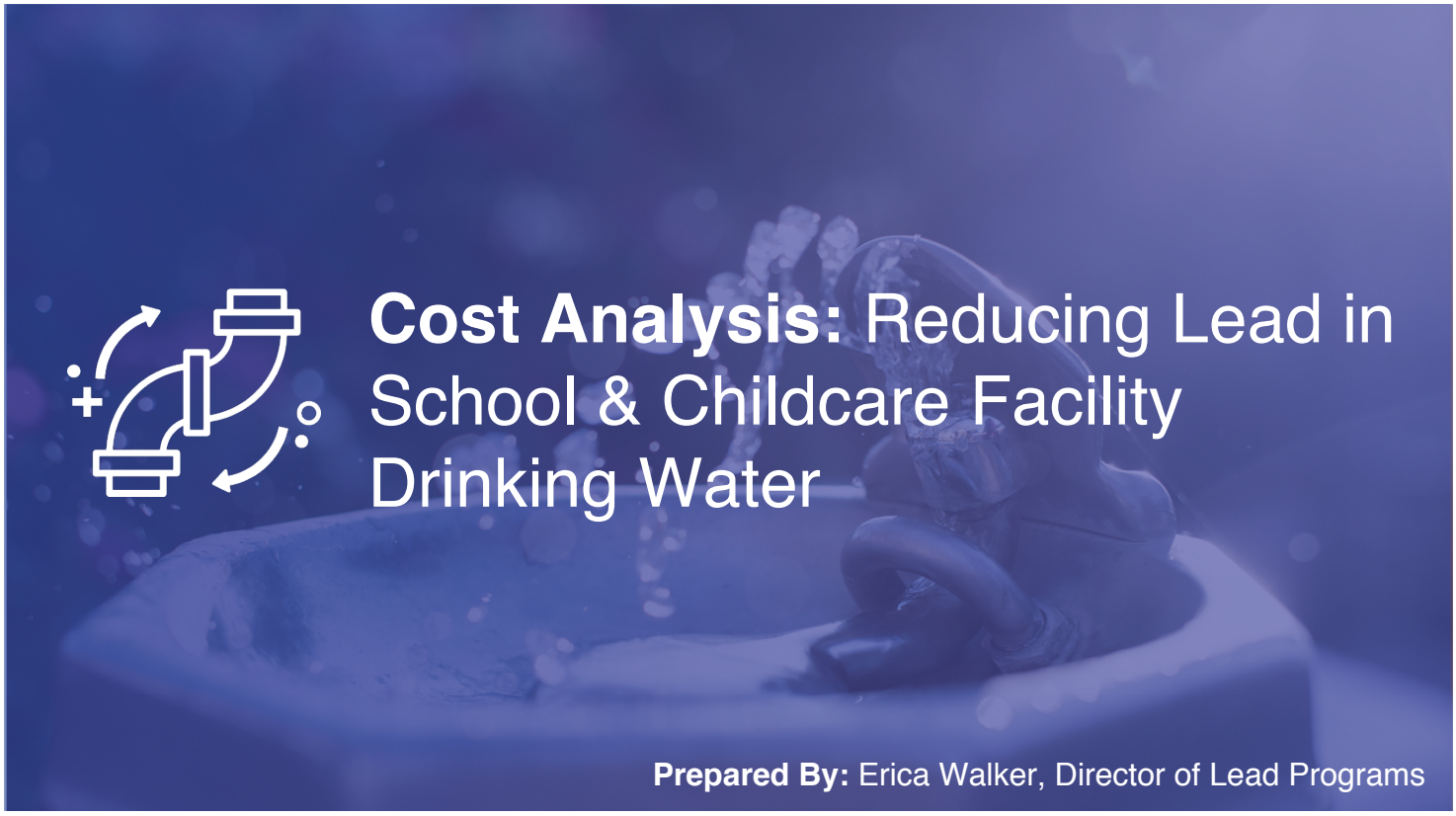

Cost Analysis: Reducing Lead in School & Childcare Facility Drinking Water

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120WaterAudit

EXECUTIVE SUMMARY

In the years following the Flint water crisis, public attention has turned to lead in school drinking water. There is no federal mandate to test water in all schools and childcare facilities and, though states have initiated a series of legislative and voluntary initiatives, many facilities remain untested. School mandates have outpaced childcare facilities mandates even though young children under 6 are most vulnerable to lead exposure. Because many schools and childcare buildings are older than the earliest laws reducing lead in plumbing materials, we suggest a majority of schools and childcare facilities will discover at least some sources of lead throughout their drinking water systems. Results from several state-wide programs in Massachusetts and Indiana support this (IFA, 2019; MDEP, 2017).

To provide of a sense of what it could cost to address the issue of lead in school and childcare facility drinking water, we estimate financial needs for state-wide lead reduction programs across the United States. Modeled costs are similar across facility types for field collection, lab analysis, and agency oversight. However, childcare facilities, especially those in small or residential buildings, may face higher remediation costs as these buildings are more likely to have lead service lines. At a minimum, we believe all cooking and drinking water fixtures in schools and childcare facilities should be tested to provide baseline water quality information. We also suggest that state environmental and public health agencies, if given adequate resources, are best positioned to offer technical assistance to schools and childcare facilities.

KEY FINDINGS

Regulated Childcare Facilities

- **368,049 facilities** in 2017-2018
- **$136-$194 Million** to analyze samples
- **$445-$657 Million** to sample, analyze, remediate fixtures, and run programs
- **9 states** have regulatory requirements

Public Schools

- **98,456 facilities** in 2015-2016
- **$156-$209 Million** to analyze samples
- **$326-$418 Million** to sample, analyze, remediate fixtures, and run programs
- **13 states** have regulatory requirements

OVERVIEW OF PUBLIC SCHOOLS & CHILDCARE FACILITIES

Lead in School & Childcare Facilities

Every day children and infants consume water in baby formula, eat school lunches prepared with water, and drink water from dozens of fixtures in classrooms, hallways, and athletic facilities. Unfortunately, lead in brass plumbing components, solder, and service lines can leach into facility drinking water or be transferred into food during the cooking process. High lead concentrations in drinking water are linked to decreased mental ability, learning difficulties, reduced growth in young children, blood anemia, and brain damage (ATDSR, 2007) and there is evidence that even low levels of exposure may cause neurological harm (Bellinger et al., 2003; Canfield et al., 2013). In this report, we provide an estimate of what it could cost to first understand the extent of lead sources in school and daycare drinking water systems and then to reduce these sources across the country. We focus on drinking water, but other important pathways of lead exposure inside and outside of school and childcare facilities include paint, soil, and dust.

Fixtures: Faucets, water coolers fountains, coffee makers, ice machines, and other plumbing products conveying drinking or cooking water

The Lead and Copper Rule (LCR) requires Public Water Systems to test a limited number of homes on a biannual, annual, or triennial basis for lead and copper. The law primarily serves as a check on water treatment and was not written to help systems strategically locate and remove lead sources. A system in which the 90th percentile sample for lead exceeds 15 ppb may have to apply corrosion control treatment to reduce the potential for lead to leach into drinking water or initiate other protective measures. A very limited number of schools and childcare facilities are considered Non-Community Non-Transient Water Systems and are required to test a portion of fixtures under the LCR. Typically, these facilities either source drinking water from a private well or provide some water treatment on site. Although older facilities are particularly at risk, lead in drinking water will likely be an issue for most schools and daycares. To understand why, we first look at how the meaning of “lead-free” plumbing has evolved over the past 33 years.

Lead Regulation for U.S. Plumbing Products & Impact on School/Childcare Facilities

In 1986 congress defined “lead-free” as solder and flux with not more than 0.2% lead and pipes with not more than 8% lead in a section of the Safe Drinking Water Act (SDWA). In 1988, the Lead Contamination Control Act (LCCA) required EPA to guide states and localities on testing and reducing lead in school and childcare drinking water. The LCCA also identified and banned water coolers that were not lead-free. Then in 1996, the SDWA was amended to include other plumbing products such as elbows, shut-off valves, and faucets. In 2011, following the realization that plumbing products with 8% lead could still leach high levels of this contaminant in drinking water, EPA lowered the maximum lead content of plumbing products to 0.25% of the “wetted surface” but this law was not enforced until 2014. The average public school building was constructed in 1957, according to the most recent data (NCES, 1999). This is twenty-nine years before Congress passed any lead regulation for plumbing products, which suggests many schools across the country have unknowingly installed leaded faucets, water coolers, and plumbing parts throughout buildings. We provide a diagram of the regulatory history below (figure 1). Water chemistry varies within plumbing systems and dictates the time, composition, and extent of lead leaching into drinking water. In addition, corrosive water and intermittent fixture use can influence high lead concentrations in large buildings (Elfland et al., 2010). For these reasons, older schools and childcare facilities are at a higher risk of lead contamination but all facilities built before 2014 face some risk.

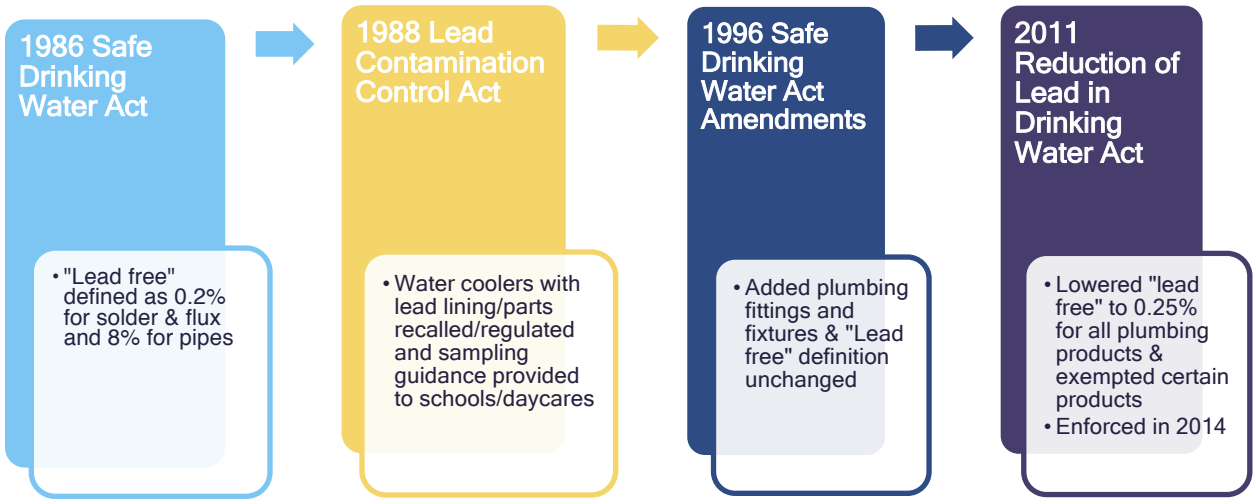

Figure 1. Regulatory history of “lead-free” plumbing definitions and standards in the U.S.

Number of Public Schools & Childcare Facilities in the United States

There were 98,456 operating public schools in the 2015-2016 academic year (NCES, 2017). A majority of states operated less than 2,000 schools, and 46 states had less than 5,000 schools (figure 2). Regulated childcare facilities are defined differently in each state but generally fall into three categories: smaller family or residential facilities, childcare centers, and school programs. We assess school childcare programs independently from public schools as these facilities have separate fixtures. Where possible, we obtained facility numbers from Childcare Aware America's annual report which includes head start programs (2017). We gathered the remaining data from agency websites and personal correspondence with licensing staff. There were 363,117 facilities regulated in 2017-2018 with 38 states overseeing less than 10,000 facilities. This results in a total of 461,573 childcare facilities (79%) and public schools (21%) across the country.

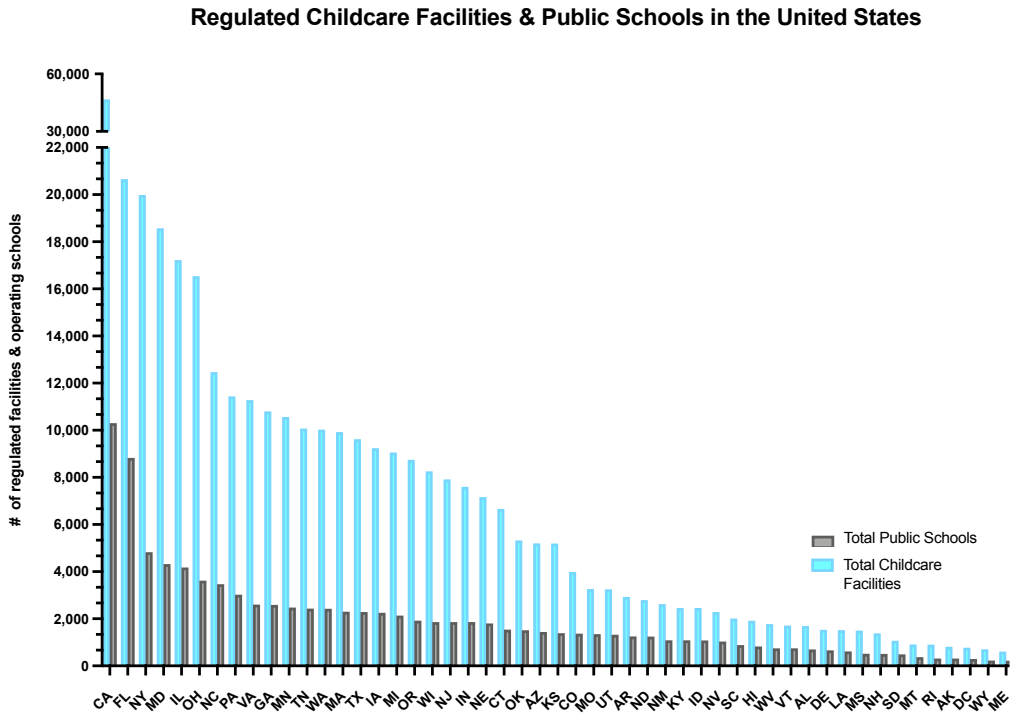

Figure 2. Operating public schools (2015-2016) and regulated daycares (2017-2018) across the United States.

It is important to note that private schools (serving an estimated 5.7 million children), foster homes (serving an estimated 427,400 children) and unregulated childcare buildings were not included in this report due to a lack of available facility data (NCES, 2017; AFCARS, 2017). However, these facilities serve a large number of children and should be included in testing and remediation efforts.

CURRENT LEGISLATIVE & VOLUNTARY EFFORTS

The community-driven response to lead risk in children's drinking water in the absence of a federal mandate is a colorful patchwork quilt of voluntary and mandatory state programs with a wide variety of standards. Programs exhibit different sampling protocols, remediation thresholds, levels of funding and technical support (Cradock et al., 2019). We now provide an overview of current regulatory and voluntary efforts in the U.S.

School Programs

As of this report, 13 states and Washington D.C. have passed or promulgated lead sampling laws and regulations for schools, 11 states have carried out voluntary testing initiatives ranging in size from small district pilots to full state coverage, and 10 states are considering new legislation. In 16 states no regulatory initiatives or voluntary programs appear to be active (figure 3). It is important to note that this report looks only at state-driven programs and does not account for lead sampling efforts initiated by school districts.

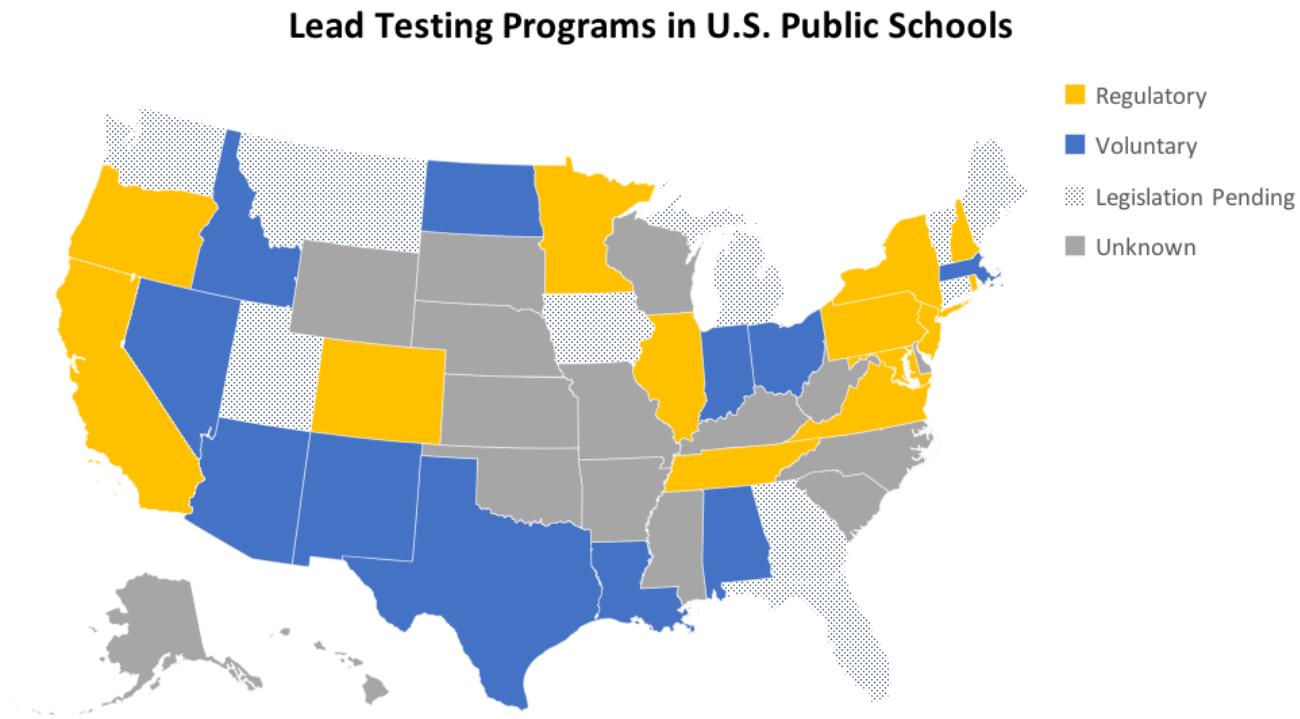

Figure 3. A map of state lead sampling initiatives in regulated public schools across the U.S. as of March 2019.

Programs for Childcare Facilities

Despite the reality that children under the age of 6 are most vulnerable to risks associated with lead exposure, lead sampling efforts in childcare centers lag notably behind school initiatives (figure 4.). As of this report, only 9 states have passed legislation with some variation of lead reduction requirements and only 2 states have initiated voluntary programs, though some school-based childcare facilities were likely tested during voluntary school sampling programs. Legislation is currently pending in 6 states, and activities in 33 states and Washington D.C. are unknown.

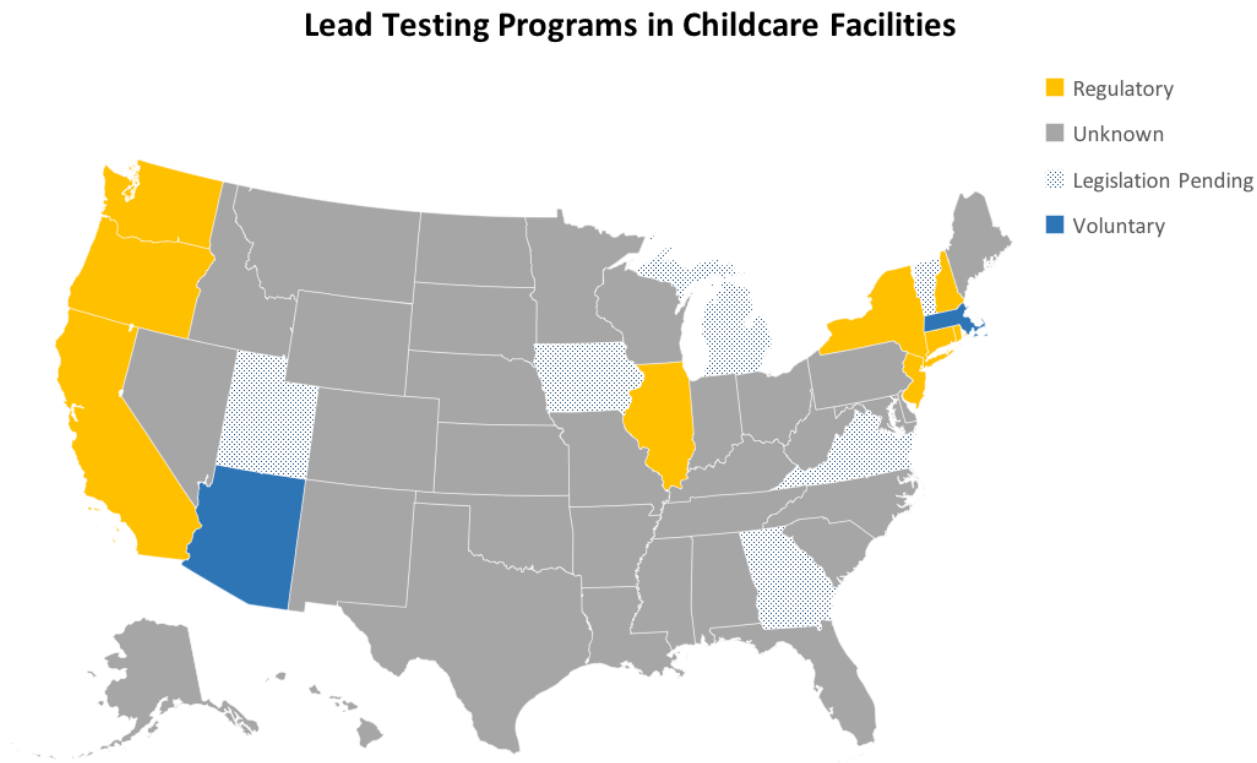

Figure 4. A map of state lead sampling initiatives in regulated childcare facilities across the U.S. as of March 2019.

NATIONAL COST ESTIMATES FOR LEAD REDUCTION IN PUBLIC SCHOOLS & CHILDCARE FACILITIES

Given the public health risks, the reality that many facilities will contain leaded plumbing products, and the landscape of current lead testing efforts in this country, we now present an estimate of what it could cost to sample, remediate, and oversee lead reduction in drinking water programs in every state. For this cost analysis, we break up each state program into four components: Field Collection, Lab Analysis, Remediation, and Agency Oversight (figure 6). Table 1 provides total costs estimated by state.

Field Collection & Lab Analysis

In most cases, states either require facilities to collect water samples or provide field teams to assist schools with this task. When schools and childcare facility staff are expected to take water samples, states provide technical assistance through webinars, on-site training, and agency guidance documents. Field teams can be comprised of agency staff, consulting firms, or university partners. For this report, we assume the state provides funds for sample planning and collection but do not include extra costs associated with training, transportation, or additional field materials. These costs can be considerable, especially for large states where more transportation funds and field staff may be needed to cover the same number of facilities. To determine lab costs, we looked at the advertised fees for 27 labs in 6 different states for analyzing water samples for total lead. Costs per sample ranged from $15 to $60 with an average cost of $26.48. We then calculated total lab cost by-state using average fixtures and sample counts obtained from existing state programs (IFA, 2019; MDEP, 2017). Our high cost estimate accounts for a higher number of fixtures and samples in both types of facilities and includes follow up samples for remediation.

Remediation

Based on results from an existing lead sampling program in Indiana, we assume that 62% of all public schools and childcare facilities will have at least 1 fixture in need of remediation at an average cost of $550 per school (IFA,2019). While this is likely a conservative cost estimate, it reflects the reality that many schools will choose from a variety of low to high-cost remediation options including fixture removal, updates to plumbing components (shut off valves, elbows, etc.), complete fixture replacement, or filtration for example. A report released this year found that 44% of all school buildings tested in 12 state-wide programs had at least one fixture over the state action level

(Craddock et al., 2019). We used IFA's (2019) less conservative value (62% of facilities at an action level of 15 ppb) since not all of the programs in the study collected from all drinking and cooking water fixtures.

In addition to fixture remediation needs, we suggest childcare facilities are more likely to contain to lead service lines (LSLs) as lead was more commonly used in residential homes or small buildings before 1940 and even until the mid 1980's in some cities. To determine the minimum LSL remediation cost for childcare facilities by state, we calculated the probability of finding an LSL in a childcare facility using national LSL survey-derived estimates by Cornwell (2016) and the number of service lines of any material by state. Due to a lack of facility-specific information, we assumed a uniform probability, meaning that childcare facilities are no more or less likely to contain an LSL than any other building in the state. To calculate our higher remediation cost estimate, we assumed state programs would find LSLs in 10% of all facilities in each state. In both scenarios, we assume an average service line replacement cost of $6,000 per line. While EPA estimated service line replacement costs vary from $2,500 to $8,000 per line (EPA, 2016), we selected a less conservative estimate because we expect childcare facilities will be less cost-effective at replacement than utilities which may be able to reduce average costs with different technologies and strategic execution.

These estimates are only meant to provide states and policymakers with a method of accounting for LSLs in state planning and should not be used to determine the location and frequency of LSLs as more facility information would be needed to evaluate this question. States should take into account that a program in Illinois, a state with approximately 17,000 childcare facilities and an estimated 726,000 LSLs, is more likely to encounter LSLs than California, a state with over 46,000 childcare facilities but with fewer expected LSLs (65,700) and should prepare to assist facilities in reducing these substantial sources of lead.

Agency Oversight

State-wide programs require dedicated leadership from agency professionals who often provide oversight to field teams and technical assistance to schools. Existing programs in Indiana and Massachusetts utilized 3-5 FTEs to do this work (IFA, 2019; MDEP, 2017). We assume agencies will need 3 FTES for every 1,000 schools, while childcare programs will need 3 FTEs for every 2000 facilities and use median household income by state ($43,904-$81,084) to model agency staffing costs (U.S. Department of Commerce, 2018).

Sources of Uncertainty

Our model is primarily based on and adapted from the reported experiences of two state-wide school testing programs (IFA, 2019; MDEP, 2017) and some cost assumptions may not hold for all childcare facilities. In terms of field collection, cost inputs embedded in sampling such as hourly wages for field staff may vary significantly by professional entity and by state. However, remediation costs present the highest amount of uncertainty. The lack of available data diminishes our ability to estimate how many LSLs will be found in each state program. We also assume state programs will find no LSLs in public schools based on service line materials conventionally used in large buildings, but no program has attempted to investigate this issue. In addition, some states require testing every 1-5 years, but we focused only on gathering baseline sampling data for this model. Finally, state action levels determine the scope of remediation needed, and these vary from 2 ppb - 20 ppb. Our model utilized an action level of 15 ppb, but a lower action level would be more protective of children's health and increase the cost of remediation.

Table 1. Total program costs (sampling, analysis, remediation, and oversight) for all U.S Public Schools & Childcare Facilities.

State	Childcare Facilities (Low)	Childcare Facilities (High)	Public Schools (Low)	Public Schools (High)
Alabama	$2,011,049	$3,294,780	$4,954,257	$6,361,550
Alaska	$985,434	$1,597,010	$1,700,018	$2,173,779
Arizona	$6,259,067	$8,827,057	$7,567,292	$9,697,350
Arkansas	$3,475,094	$5,249,949	$3,564,600	$4,579,269
California	$56,859,398	$89,436,047	$34,402,510	$44,011,088
Colorado	$4,877,178	$7,316,668	$6,242,012	$7,978,514
Connecticut	$8,138,357	$11,340,448	$4,583,604	$5,860,333
Delaware	$1,849,913	$2,727,89[illegible]	$739,636	$947,606
District of Columbia	$955,455	$1,372,060	$770,628	$983,260
Florida	$24,630,652	$33,617,317	$14,223,023	$18,253,721
Georgia	$12,933,110	$18,170,695	$7,582,048	$9,724,230
Hawaii	$2,341,857	$3,473,924	$971,652	$1,242,106
Idaho	$2,950,032	$4,083,078	$2,462,955	$3,156,810
Illinois	$20,871,027	$31,844,015	$13,876,143	$17,769,748
Indiana	$9,125,466	$12,471,353	$6,351,631	$8,143,155
Iowa	$11,193,317	$16,972,591	$4,479,008	$5,737,085
Kansas	$6,243,462	$9,947,462	$4,360,509	$5,591,541
Kentucky	$2,923,725	$4,635,602	$5,060,404	$6,497,540
Louisiana	$1,786,650	$2,937,601	$4,533,498	$5,829,812
Maine	$721,118	$1,180,546	$2,007,008	$2,576,827
Maryland	$22,929,122	$31,545,190	$4,847,076	$6,187,222
Massachusetts	$17,115,546	$24,562,660	$6,236,734	$7,973,235
Michigan	$11,919,979	$19,069,328	$11,454,457	$14,688,714
Minnesota	$12,974,161	$20,904,620	$8,290,298	$10,601,280
Mississippi	$1,765,589	$2,903,642	$3,507,892	$4,511,370
Missouri	$3,911,244	$6,120,147	$8,000,303	$10,260,925
Montana	$1,088,240	$1,775,063	$2,721,711	$3,489,241
Nebraska	$8,638,376	$12,169,844	$3,589,893	$4,601,764
Nevada	$2,739,058	$4,261,168	$2,184,236	$2,801,617
New Hampshire	$1,691,407	$2,427,449	$1,643,559	$2,100,533
New Jersey	$9,671,727	$13,993,716	$8,666,671	$11,080,240
New Mexico	$3,102,209	$4,661,242	$2,893,655	$3,718,073
New York	$24,140,017	$37,605,782	$16,001,888	$20,500,751
North Carolina	$14,801,001	$20,753,117	$8,539,998	$10,967,556
North Dakota	$3,358,115	$4,728,478	$1,714,299	$2,197,386
Ohio	$19,897,640	$27,935,489	$11,975,647	$15,350,727
Oklahoma	$6,362,047	$9,138,659	$5,930,672	$7,609,352
Oregon	$10,572,250	$14,966,886	$4,127,948	$5,286,238
Pennsylvania	$13,797,984	$19,644,721	$10,021,024	$12,836,543
Rhode Island	$1,094,626	$1,717,277	$1,041,968	$1,333,871
South Carolina	$2,403,019	$3,929,550	$4,111,802	$5,275,687
South Dakota	$1,279,072	$2,000,145	$2,303,736	$2,954,691
Tennessee	$12,035,306	$16,305,956	$6,126,372	$7,860,075
Texas	$11,553,560	$18,382,518	$29,193,628	$37,424,755
Utah	$3,961,472	$5,628,530	$3,454,101	$4,417,477
Vermont	$2,066,904	$3,080,386	$1,042,862	$1,335,698
Virginia	$13,759,771	$20,781,446	$7,132,067	$9,121,303
Washington	$12,280,964	$16,907,447	$8,145,143	$10,408,563
West Virginia	$2,097,318	$3,386,249	$2,429,886	$3,123,741
Wisconsin	$9,976,791	$13,873,417	$7,486,945	$9,589,958
Wyoming	$846,716	$1,381,893	$1,222,225	$1,567,287
Totals	**$444,962,591**	**$657,038,112**	**$326,471,133**	**$418,291,198**

CONCLUSION

We present a financial estimate to sample, remediate, and manage state-wide lead reduction in drinking water programs. Our analysis suggests it could cost between $771 million to $1.08 billion to enable states to run lead reduction in drinking water programs for both public schools and regulated childcare facilities across the nation. Costs associated with field sampling, lab analysis, and agency oversight are similar though childcare centers represent 79% of all facilities, which is because childcare centers will likely have fewer drinking water fixtures on average (figure 6.). The possibility of lead service lines in childcare buildings, particularly in residential homes, drove total estimated remediation costs up for these facilities.

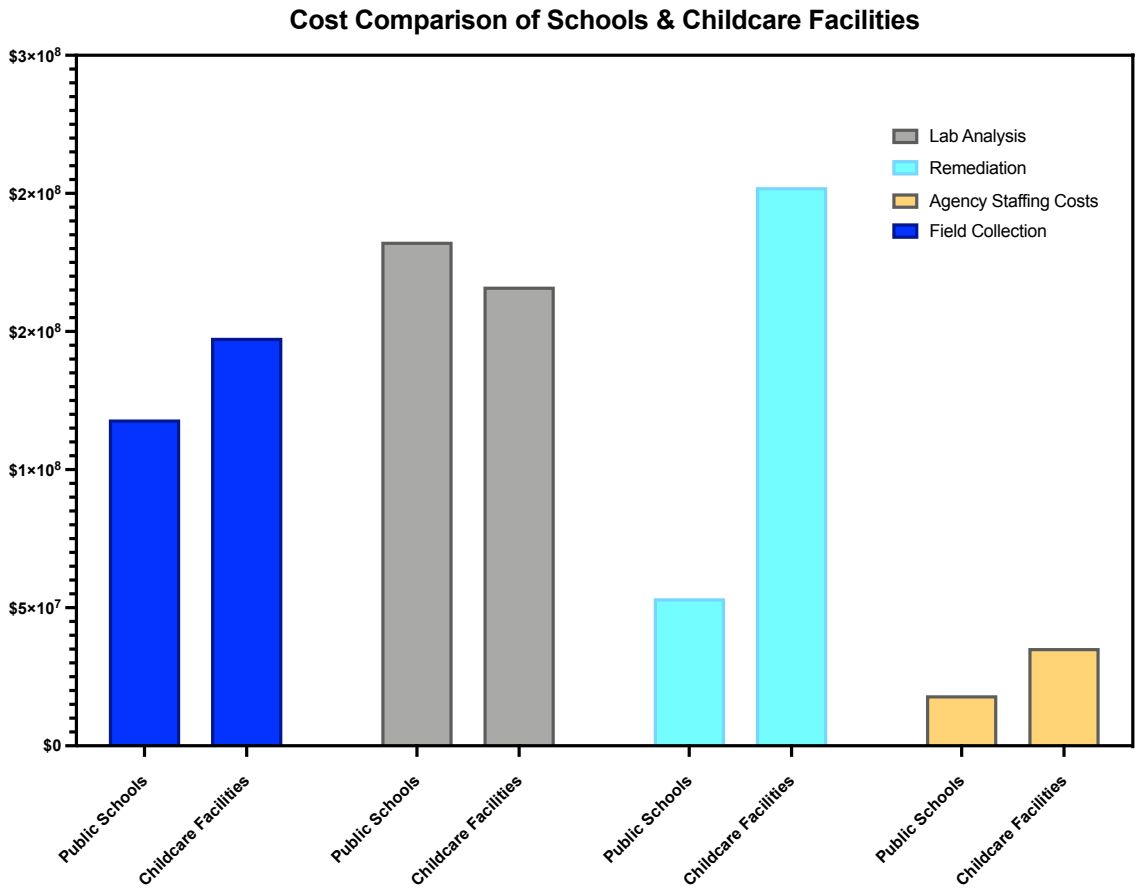

Figure 6. Total estimated cost to collect, analyze, remediate and oversee lead reduction in drinking programs for all public schools & childcare facilities in the U.S.

In place of a federal mandate to test lead in water in most schools and childcare facilities, states have initiated a flurry of legislative and voluntary initiatives. Almost 11,000 schools had been sampled as of February 2018 (Craddock et al., 2019) and, though this number is likely higher today, many facilities around the country have not yet received the support they need. Because the average school is older than regulatory efforts to reduce lead in plumbing materials, we suggest a majority of schools and childcare facilities will discover sources of lead throughout their drinking water systems. Though less is known about the state of child care infrastructure, we assume similar risks for this group of facilities. Environmental justice is also a concern as many schools and childcare centers in low-income areas with older infrastructure may not have the financial capacity to both test for and reduce sources of lead. We believe environmental and public health agencies are in an excellent position to assist if given adequate financial support and the potential benefits associated with an investment this size are notable. For example, one researcher found that $7-$221 dollars could be returned in health benefits, increased IQ, higher lifetime earnings, tax revenue, reduced spending on special education, and reduced criminal activity for every $1 spent on lead hazard control (Gould, 2009).

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