




FLINT LEAD

FREE

DATA TRENDS &
MULTI-SECTOR
COLLABORATION



FLINTREGISTRY



Mission To eliminate lead exposure in Flint, Michigan.

Vision Through tracking and reporting on environmental lead risks, blood lead levels, environmental assessments, and interventions and by providing a clearinghouse of lead-related programming and education/training, Flint, MI will be a *model lead-free city* through the collaboration and convening of community, governmental agencies, and nonprofit organizations.

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Flint Lead Free

Founded in 2017, **Flint Lead Free** comprises a diverse group of public, private, and nonprofit members with a shared mission of lead elimination. Through primary prevention and data-driven efforts, Flint has been uniquely positioned to accomplish this goal because of a confluence of programs including lead service line removal, lead fixture replacement, home investigation and abatement, and community-wide engagement and awareness.

 ver the past five years, **Flint Lead Free** has made intentional connections to strengthen collaborations, generate greater transparency, and increase access to services and information. In addition to routine convenings and serving as a clearinghouse of lead-related programming, Flint Lead Free has published two reports (2017 and 2021) that track, monitor, and share data from programs and services to reflect lead-related progress and challenges, as well as to drive programming. In 2021, in an alignment of shared goals, Flint Lead Free joined forces with the Local Initiatives Support Corporation (LISC) Flint Healthy Homes group to collaboratively work together toward lead elimination.

This 2023 Flint Lead Free report builds upon previous reports while capturing the opportunities and obstacles in lead elimination that have been compounded by the COVID-19 pandemic's impact on healthcare access, home-based inspection/abatement work, and workforce capacity.

This report does not include all lead-related activities currently taking place in Flint, and due to the time lag of collecting complete data, it retrospectively reflects trended information up to the end of 2021. Despite these challenges, this report features Flint Lead Free's broad and proactive efforts to reduce environmental lead exposure, share progress made from new investments and strategic partnerships, demonstrate the positive impact of lead elimination, and highlight the excellent work of partners.

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Leadership & Flint Registry

A workgroup of the Flint Registry, Flint Lead Free is co-chaired by Jenny LaChance, Associate Director of MSU-Hurley Pediatric Public Health Initiative, and Lydia Starrs, Program Officer at the Community Foundation of Greater Flint.

With grant support to Michigan State University from the Centers for Disease Control and Prevention's (CDC's) National Center for Environmental Health (NCEH) and Lead Poisoning Prevention and Environmental Health Tracking Branch, the Flint Registry contributes to lead elimination efforts by enrolling individuals exposed to the lead-contaminated Flint water, screening for ongoing environmental lead exposure via a survey of environmental risks, and connecting individuals to lead-mitigating services.

Flint Lead Free Members

Flint Lead Free is a multidisciplinary group of partners from local, state, and national organizations including residents, property managers, housing organizations, legal services, community organizations, foundations, and city/county/state government. This diverse group of partners regularly convenes for strategic conversations related to efforts to eliminate lead exposure in Flint, sharing best practices, developing new partnerships and initiatives, and providing feedback to the Flint Registry.

- Altarum
- City of Flint
- Community Foundation of Greater Flint
- Flint Registry
- Flint residents/parents
- Genesee County Habitat for Humanity
- Genesee County Health Department
- Genesee County Land Bank
- Genesee Health System
- Greater Flint Health Coalition, Elevated Blood Lead Level Nurse Case Management Program
- Legal Services of Eastern Michigan
- Local Initiatives Support Corporation
- Michigan Department of Health and Human Services, Lead Safe Homes Program & Child Lead Poisoning Prevention Program
- Michigan State University and Hurley Children's Hospital Pediatric Public Health Initiative
- Michigan State University Institute for Health Policy



Environmental Testing & Elimination

The focus of Flint Lead Free's efforts is primary prevention. Primary prevention refers to eliminating lead exposure before a child is poisoned. Because there is no safe level of lead exposure and no available treatment, primary prevention is the recommended intervention and contributes most significantly to health and development outcomes and to lifetime savings on societal, healthcare, and education costs. As such, the following section attempts to capture the burden of lead in the environment and efforts to reduce that burden over time.

Water

Recognizing no safe level of lead, the Environmental Protection Agency's Maximum Contaminant Level Goal for lead in water is set at a non-enforceable 0 ppb (parts per billion). The non-health-based action level for a water system is 15 ppb, and the action level for bottled water as set by the Food and Drug Administration is 5 ppb. If present, the largest contributor of lead in water is a lead service line. Lead can also be released from lead-based indoor plumbing and fixtures. Primary prevention for lead in water is removal of lead from the drinking water delivery system. A point-of-use lead-clearing filter, if properly installed and maintained, also prevents lead in water exposure.



Flint Residential Water Lead Testing Results: ≥ 10 ppb

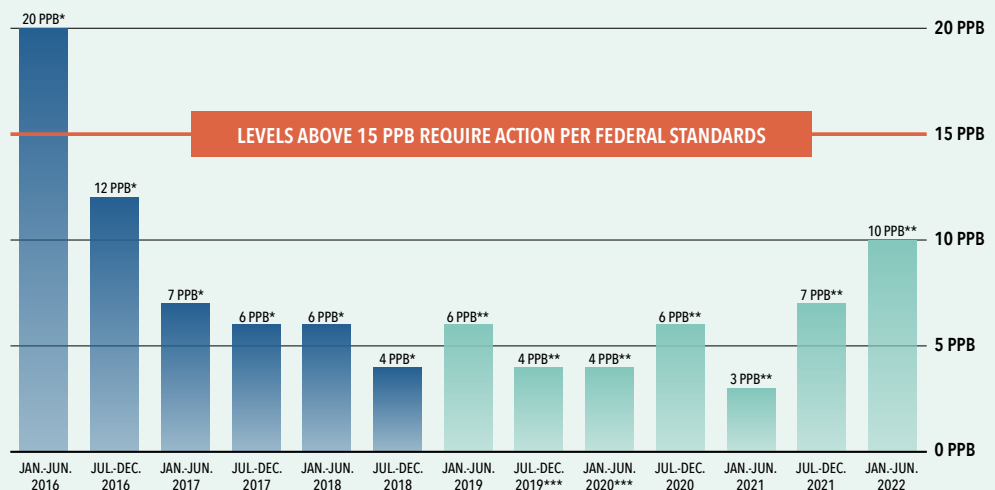
The data below reflects the total number of residential water tests with lead results equal to or above 10 ppb, consistent with previous Flint Lead Free reports. The results are from residential and business sampling kits distributed by the City of Flint and State of Michigan. With overall improved water quality and a reduction of resources dedicated to water test kit distribution, a reduction in locations for test kit pick-up, and no ongoing communication campaign to encourage residential water testing, the number of residential water tests has steadily dropped since the water crisis. All results are posted online.

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number tested			672	25,604	4,482	1,337	431	832	641
Number ≥ 10 ppb			77	2,948	267	33	13	10	16
Percent ≥ 10 ppb			11.5	11.5	6.0	2.4	3.0	1.2	2.4

Lead and Copper Rule Compliance Sampling

Flint undergoes Lead and Copper Rule (LCR) compliance testing during six-month intervals. The Michigan Department of Environment, Great Lakes, and Energy (EGLE) figure below notes Flint's LCR monitoring results from 2016 to 2022. Beginning in 2019, LCR monitoring was performed under the strengthened Michigan LCR rule, which requires 1st and 5th liter samples from homes with lead service lines to better detect the potential contribution of lead release from lead service lines. As the number of homes with lead service lines has decreased because of city-wide pipe replacement, the ability to conduct this compliance sampling from homes with lead service lines has been limited. The system-wide results have been in compliance (< 15 ppb) since late 2016; however, the last two six-month testing cycles have noted an increase in the system's lead levels. More information at www.michigan.gov/flintwater and current LCR results at www.michigan.gov/mileadsafe.

Lead and Copper Rule (LCR) Monitoring results in Flint, Michigan



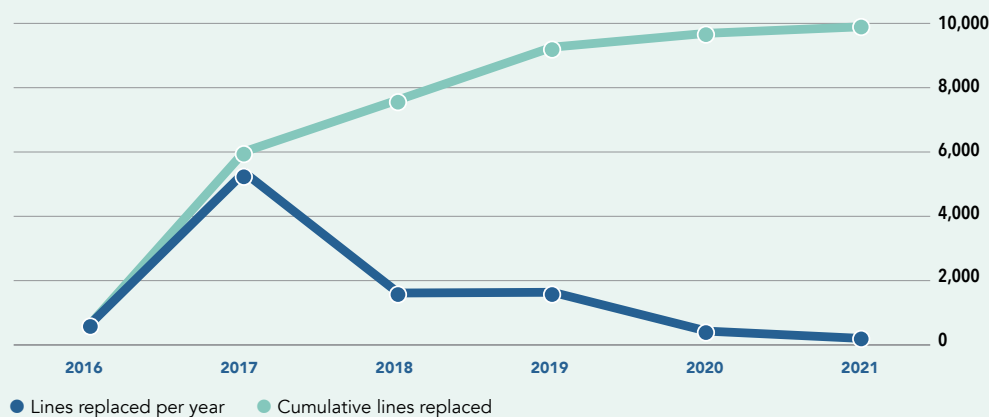
* represents the 90th percentile value for 1st draw 1 liter samples used for compliance (federal LCR)

** represents the 90th percentile value using the highest of either the 1st or the 5th liter sample results (new Michigan LCR)

*** during this monitoring period, the 90th percentile value was calculated using only 49 sites validated for compliance

<https://www.michigan.gov/flintwater>

Lead Service Lines Replaced





Flint Lead Service Line Replacements

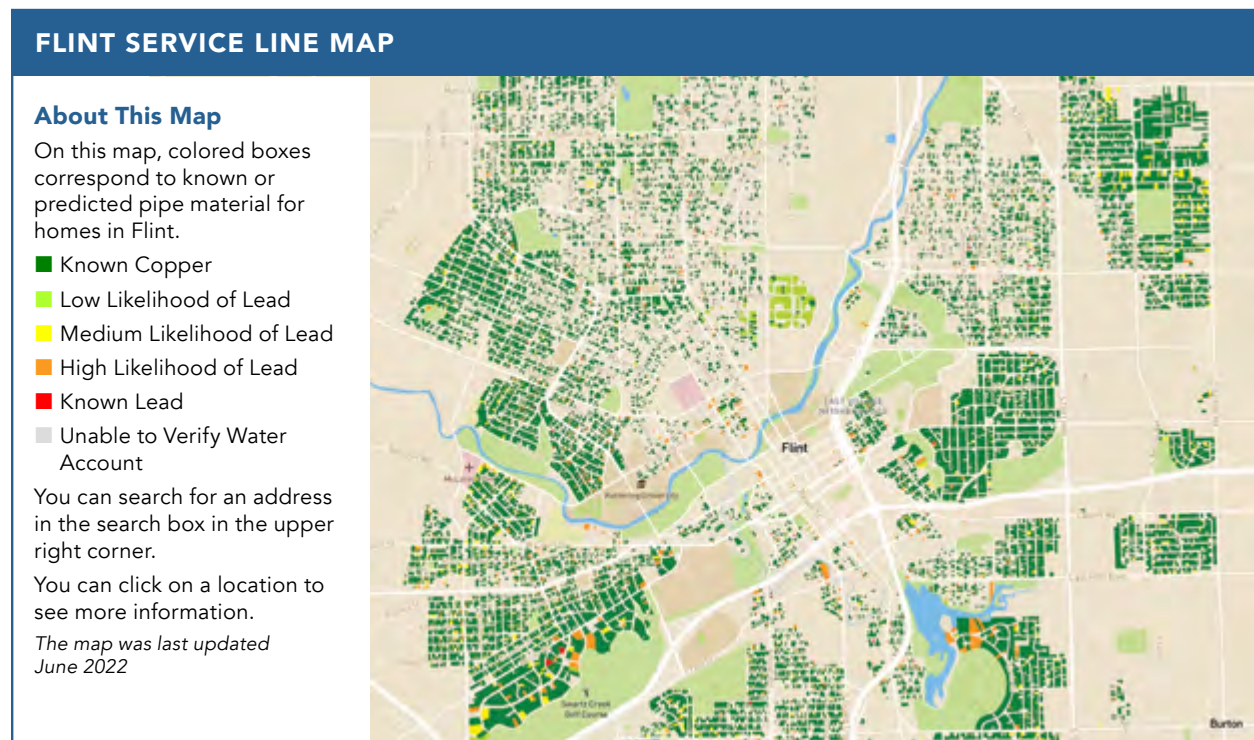
As a result of a 2017 Flint water crisis settlement agreement, the city began replacing lead and galvanized service lines with completion initially intended for early 2020. However, due to COVID-19 and other challenges, complete pipe replacement has not been achieved yet. Flint residents must opt into the service line replacement program by completing a form and providing consent for contractors to inspect the line entering their home. According to the City, 172 residents have expressly declined to have their service lines inspected or replaced, and 780 residents have not responded to the City's request for permission to conduct a service line inspection or replacement. Recent data from the City of Flint (from City of Flint Progress Report on Flint Water in December 2022) reports approximately 27,428 excavations at replacement-eligible homes and approximately 10,135 lead or galvanized steel service line replacements. There were 9,894 lead or galvanized steel service lines replaced through 2021. (See table below.) As of September 2022, the City estimates that about 1,400 service lines at replacement-eligible homes remain to be excavated. As the residential pipe replacement concludes, the City of Flint and local crews are gearing up for the next phase, assessing approximately 1,500 commercial properties for lead or galvanized pipes for replacement by 2024.

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of Service Lines Replaced				644	5365	1615	1637	430	203

Lead Service Line Data Sharing: Flint Service Line Map

As the City of Flint works to complete the pipe replacement project, BlueConduit released the Flint Service Line Map (www.flintpipemap.org), an interactive tool that allows residents to examine residential water service line materials and predictions across Flint. The information represented on the map came from the City of Flint's inspection of thousands of water pipes since 2016 and is updated as the City reports new data. For homes where the City has not verified the pipe material, the map mathematically displays the results of BlueConduit's home-by-home predictive model. This model is used in decision-making to target homes for line replacement as well as for secondary prevention services, like Flint Registry enrollment.

The map was built to be user-friendly and accessible to people with diverse abilities and needs. Community feedback was integrated throughout the development of the map to ensure that the map reflected the needs of Flint residents. The ongoing collection of feedback and updates to the map website ensure data is transparent and useful. As one of the only cities with address-specific historic and current service line information, the Flint Service Line Map clearly communicates water pipe materials to Flint residents, giving the people of Flint a powerful tool to help them advocate for safer drinking water infrastructure.





In addition to lead in water, children can be exposed to lead from several additional and common household sources, including paint, soil, and dust.

Housing

In addition to lead in water, children can be exposed to lead from several additional and common household sources, including paint, soil, and dust. Lead exposure is a well-known environmental injustice, and Flint children are often exposed to multiple sources of lead. With an older and often deteriorating housing stock, many homes in Flint were built before lead paint was restricted and/or have contaminated soil from leaded gasoline deposits. All sources of lead are dangerous, and primary prevention for lead in housing includes inspection and abatement/home improvement prior to a child being exposed, as well as lead safe home demolition.

MDHHS Lead Safe Home Program

Deteriorated lead-based paint, lead in soil, lead in dust, and lead in drinking water can present lead hazards and a source of lead exposure. The Michigan Department of Health and Human Services (MDHHS) Lead Safe Home Program (LSHP) aids owner occupants and rental property owners in identifying lead-based paint, lead in soil or dust, and lead in drinking water hazards within their home and provides resources to remediate the identified hazards.

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LSHP Tables

The set of tables below provides information about activities conducted by the MDHHS-LSHP in the City of Flint through the calendar year 2021 regardless of funding source. This data represents lead identification and abatement activities conducted on City of Flint homes in a historical manner. LSHP cases are completed over a period of 12-18 months and these data points represent the activities that occurred during this snapshot in time.

Interpretation of Tables

The LSHP process is lengthy given its complexity and the period from application to completed abatement may span one or more years. Depending on factors, including when it was received, applications may not move forward to environmental investigation or abatement until the following or subsequent years. Therefore, these tables should not be used to demonstrate the progress of a case over one calendar year. Data users should take caution when associating one variable with another. Summation of the count within a year does not provide complete data as one household can receive multiple services in a given year.

Environmental Investigations

The purpose of an environmental investigation (EI) is to determine the existence of a lead hazard at the subject property and to determine the location, type, and severity of existing or potential health hazards associated with exposures to lead. A lead hazard is any condition that causes exposure to lead from dust, soil, paint, or drinking water. Beginning in calendar year 2018, a completed and approved LSHP application was required for the EI service. An EI report expires after 12 months, and a risk assessment must be performed to update the expired EI report.

Of special note, in calendar years 2020 and 2021, due to the novel Coronavirus Disease and the stay-at-home executive orders, the number of new EIs performed drastically decreased from previous years.

The data below represents the number of new EIs conducted in the City of Flint, the number of these EIs completed on a home housing a child with a blood lead level ≥ 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$), the number EIs completed identifying any type of lead hazard, and the type of lead hazard identified. A breakdown of the types of hazards provides the number of homes identified with each specific lead hazard. The table also includes the number of risk assessments conducted on completed and expired EIs.

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
1. Environmental investigations completed	0	0	15	141	259	340	194	6	6
1a. Environmental investigations completed on homes with child with BLL $\geq 5 \mu\text{g}/\text{dL}$	0	0	13	117	62	8	6	5	4
1b. Environmental investigations identifying any type of lead hazard	0	0	15 (100%)	116 (82%)	206 (80%)	321 (94%)	189 (97%)	5 (83%)	4 (67%)
1b.1. Paint hazard ¹	0	0	14	111	199	294	176	4	3
1b.2. Soil hazard ²	0	0	5	33	33	44	14	1	0
1b.3. Dust hazard ³	0	0	14	100	180	261	156	5	4
1b.4. Water hazard ⁴	0	0	2	19	97	102	40	0	2
2. Risk assessments completed on previously completed and expired environmental investigations								112	138
3. Total number of completed lead hazard home investigations								118	144

¹ A lead-based paint hazard is defined as any housing component identified by approved lead paint analysis as containing lead paint in deteriorated condition or designated as friction/impact surfaces.

² A soil hazard is defined by Housing and Urban Development (HUD) as any bare soil area accessible to and frequented by children that test above standard protocol measures, including foundation drip line and child play areas: Dripline 1,200 ppm, Child Play Area 400 ppm.

³ A dust hazard is defined as a measurable sample of lead in house dust above the standard protocol measures: Floors $\geq 10 \mu\text{g}/\text{ft}^2$, Windowsills $\geq 100 \mu\text{g}/\text{ft}^2$, and Window Troughs $\geq 100 \mu\text{g}/\text{ft}^2$.

⁴ A lead in water hazard is defined as a measurable sample of lead present in water from the faucets, plumbing materials or service lines within a home, above the standard protocol measure of 15 ppb.

LSHP Applications for City of Flint Households

Prior to providing abatement services on a home, a property owner and/or occupant must first submit a LSHP application, and that application must be received by the LSHP. This application collects data necessary to determine eligibility of a household for the LSHP. If eligible, the LSHP then aids owner occupants and rental property owners in identifying lead hazards within their home and provides resources to remediate the identified hazards.

An application may be ineligible for services if the household did not meet eligibility requirements as outlined in LSHP policy. A household is eligible for re-application if the ineligibility factor is resolved or changed. Reasons for ineligibility may include the household being over the income level or not enrolled in Medicaid, failure to complete application or provide necessary documentation after several outreach attempts by LSHP staff, home in a condition that reflects uninhabitability or being structurally unsound, closure due to referral to City of Flint HUD program, or failure of applicant to return contact to LSHP staff for scheduling.

An application may be placed on hold for reasons including the need for proof of ownership, additional application information, or proof of income.

The data below represents the number of LSHP applications received, approved, ineligible, and on hold for City of Flint homes. In some instances, the LSHP application could be received in a given year and approved in the following year.

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
1. Applications received	2	17	16	95	360	726	441	304	297
2. Applications approved	0	11	14	82	283	350	287	179	131
3. Applications ineligible	2	6	2	13	77	376	154	76	163
4. Applications on hold								49	3

The data below represents the number of applications received from City of Flint homes occupied by a child with a blood lead level > 5 µg/dL, as well as the individuals residing in a City of Flint home where a LSHP application has been submitted, specifically the number of children under 6 years of age, number of children 6 to 17 years of age, number of children under 6 years of age with a blood lead level > 5 µg/dL, and number of pregnant persons.

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
1. Applications received for homes occupied by at least one child with BLL ≥ 5 µg/dL	2	3	8	26	14	13	16	8	6
2. Children under 6 years of age residing in homes with submitted application	2	15	21	114	179	361	277	169	156
3. Children 6 years to 17 years of age residing in homes with submitted application	1	9	12	84	341	574	450	378	346
4. Children under 6 years of age with BLL ≥ 5 µg/dL residing in homes with submitted application	2	4	11	32	19	18	20	10	6
5. Pregnant persons residing in homes with submitted application	0	3	3	6	4	6	10	5	6

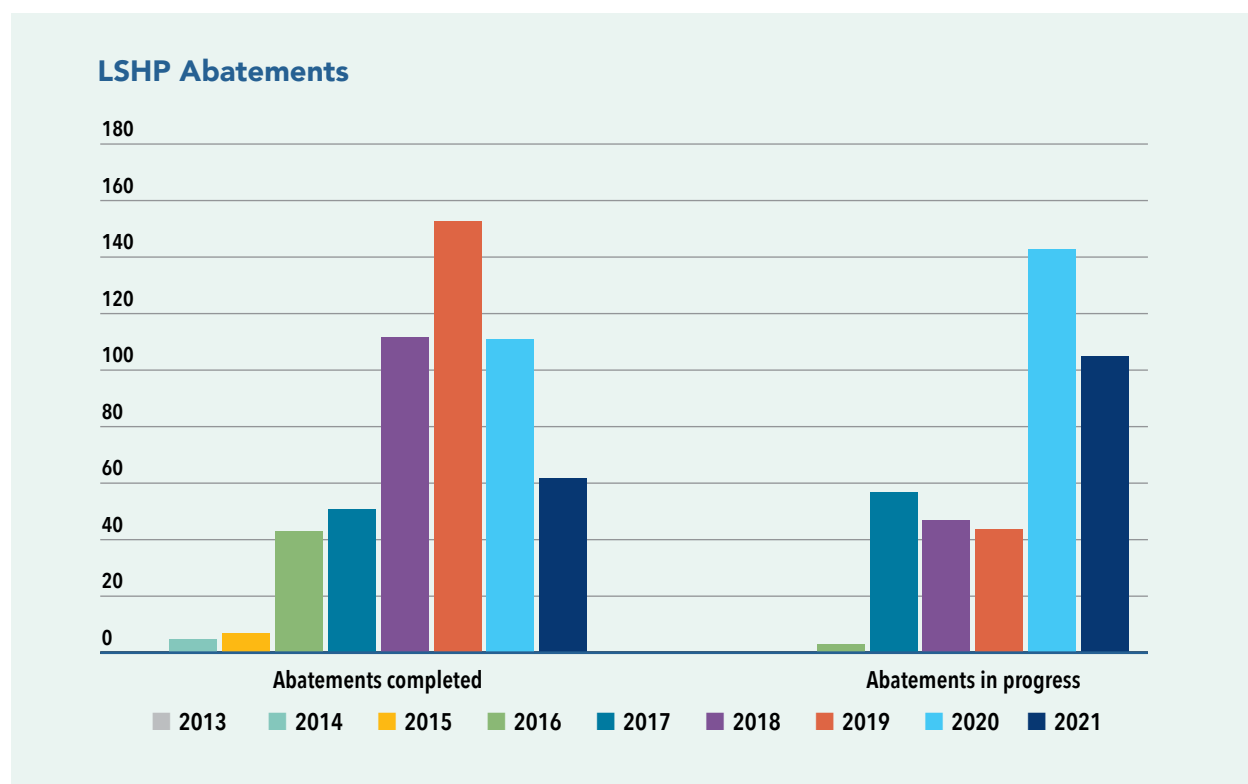
LSHP Abatements

The LSHP provides lead abatement activities on homes in the City of Flint. These abatement activities are completed to properly encapsulate, enclose, remove, and/or replace identified lead hazards. An approved LSHP application is required before abatement work can take place.

The data below represents the number of LSHP abatements completed and in progress during the referenced year. LSHP abatements in progress is defined as those units where lead hazards have been identified, a LSHP application has been received and approved, and/or the project has been bid upon and awarded to a lead contractor, but work has not yet been completed. In many instances, the LSHP application could be received in one year and abatement not completed until the following year.



Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
1. Abatements completed	0	5	7	43	51	112	153	111	62
2. Abatements in progress	0	0	0	3	57	47	44	143	105



LSHP Engagement through Genesee Health System Community Health Worker Project

The Genesee Health System is contracted through the MDHHS Lead Services Section to provide outreach services through a network of Community Health Workers (CHW) following a documented engagement protocol to Medicaid households in Flint, Michigan, eligible for LSHP Services through the Michigan Child Health Insurance Program Health Services Initiative. The purpose of this project is to maximize both 1) the number of children less than nineteen years of age, pregnant persons, and developing fetuses protected from lead poisoning, and 2) the number of housing units where lead hazards are controlled through increased enrollment in the LSHP. The LSHP, through the MDHHS Office of Strategic Partnerships and Medicaid Administrative Services, provides a list monthly of Medicaid-enrolled individuals residing in the City of Flint to Genesee Health System (GHS) for outreach and engagement.

The following data represents the number of households referred to GHS for engagement into the LSHP and the number of LSHP applications generated by GHS for enrollment. For these applications, GHS had a direct hand in every step of the submission process, which drastically increased the completion success rate.

Calendar Year	2017	2018	2019	2020	2021
Number of individuals successfully contacted	2	1,299	645	1,126	570
Number of applications provided by GHS ¹	2	729	557	384	337
Number of applications received by LSHP ²	2	469	182	194	270
Number of Medicaid households referred to GHS for engagement in LSHP	*	1,891	1,340	1,980	519
Application completion rate	100%	36%	28%	17%	52%

¹GHS total applications provided to residents, which may or may not result in a completed and submitted application to LSHP

²Applications received by LSHP refers to total applications received by all means of submission and referral

*Data not collected

City of Flint HUD Lead-Based Paint Hazard Control Grant

In 2018, the City of Flint received its first Housing and Urban Development (HUD) Lead-Based Paint Hazard and Healthy Housing Grant. The \$2.2 million award helped build the City's capacity to address lead exposure in Flint homes, incorporate healthy housing practices into city planning and development efforts, and provide lead inspection training and certification to city staff. In 2020, after changes within the City of Flint administration, the Lead-Based Paint Hazard Control project was launched in partnership with Flint Local Initiatives Support Corporation (LISC) and the Greater Flint Health Coalition (GFHC). The City of Flint Office of Public Health works in conjunction with LISC and GFHC to implement the Lead-Based Paint Hazard Control (LBPHC) program to remediate lead-based paint hazards in City of Flint homes. This program is available to homeowners and rental property owners who meet qualification criteria, which include having a child in the home who is under 6 years of age or a pregnant person. Those who qualify can receive up to \$15,000 for repairs designed to remediate lead-based paint hazards. Repairs may include replacing old wooden windows that have chipped paint with new vinyl windows, vinyl siding, and aluminum trim, covering porch floors and ceilings, and fresh paint.

The COVID-19 pandemic has had a serious impact on the implementation of the City of Flint Lead-Based Paint Hazard Control project. The executive order suspended all lead projects during the early months of the pandemic. No inspections or contractual work was done during this time. Although restrictions have been lifted, the program has faced challenges with regaining momentum and lingering concerns of safety has prevented some residents from taking advantage of the program services. During the 2022 program year, the Lead-Based Paint Hazard Control program has been working to get back on track with benchmarks and goals set for the program.

Calendar Year	2020	2021
1a. Applications received	24	48
1b. Applications approved	8	19
1c. Applications ineligible	2	10
2. Environmental investigations/lead risk assessment completed	0	11
3a. Abatements completed	0	0
3b. Abatements in progress	0	0

Genesee County Habitat for Humanity Home Repair Lead Interventions

Since 2015, Genesee County Habitat for Humanity (Habitat) has been helping Flint families address dangerous conditions in their homes via their Home Repair Program, ensuring stability and health through housing interventions. Repairs for eligible households include roof repair/replacement, structural damage, porch repair, electric, plumbing, HVAC, handicap accessibility, siding, exterior paint, weatherization, or energy efficiency. Depending on the household's needs, numerous repair program interventions can potentially bring about the identification of lead hazards internally or externally. Lead safe work practices require Habitat to complete repair projects in a way that protects the health of residents. Similarly, Habitat is committed to resolving the lead risk exposure through mitigation and abatement. A strong partner of the Lead Safe Home Program (LSHP), Habitat identifies opportunities that leverage funding resources when lead mitigation and abatement are required. In partnership with United Way, Habitat began distributing point of use (faucet), pitcher, and shower filters and cartridges in response to the water crisis in Flint. These filter distributions are part of a wider community distribution of filter resources for Flint families to help protect them from lead exposure in their water. The data table on page 16 reflects multi-source lead mitigation interventions across various housing programs provided by Habitat between 2015 and 2021 and reflects the impact of COVID-19 on services.



Calendar Year	2015	2016	2017	2018	2019	2020	2021
Homes repaired in partnership with MDHHS Lead Safe Home Program	0	0	4	9	3	1	3
Reverse osmosis system	5	35	18	18	0	0	25
3M filter	0	0	157	0	0	0	8
Faucets	1	3	165	32	0	6	9
Faucet filters	0	0	29	29	463	0	0
Faucet cartridges	0	0	0	0	964	0	2
Pitcher filter	0	0	1,198	0	51	0	8
Pitcher cartridge	0	0	0	0	102	0	147
Water heater (new)	1	9	59	18	0	9	19
Water heater (flush)	0	0	10	0	0	0	6
Boiler (new)	0	0	1	0	0	0	13
Porch repair	4	10	8	8	3	8	6
Windows replacement	16	240	20	103	45	71	0
Doors replacement	0	13	7	10	0	20	0
Siding repair/replacement	0	7	0	3	2	5	0
Fascia repair/replacement	0	6	2	3	2	12	0
Soffit repair/replacement	0	4	2	3	1	7	0

Genesee County Land Bank Authority Demolition Data

In 2014, the Genesee County Land Bank Authority received federal Hardest Hit Funding to demolish more than 4,700 blighted or abandoned properties in Flint and Genesee County. Flint housing stock is predominantly pre-1978 and while not a requirement under the Lead Renovation, Repair, and Painting Rule, the Land Bank follows the recommended guidelines for Flint homes identified for demolition to be removed using lead safe demolition practices that mitigate lead exposure to workers, surrounding properties, and residents. The following table details, by fiscal year, the number of houses demolished in Flint. If done properly, house demolition is an effective form of primary prevention — removing deteriorating and likely lead-contaminated homes from the housing stock.

Fiscal Year (October 1 thru September 30)	2013	2014	2015	2016	2017	2018	2019	2020	2021
Homes demolished	496	296	132	352	546	556	1030	317	138



All sources of lead are dangerous, and primary prevention for lead in housing includes inspection and abatement/home improvement prior to a child being exposed, as well as lead safe home demolition.

Lead Education & Workforce Development

Flint Lead Free partners have worked to increase lead education to multiple audiences including community health workers, health care providers, public health and housing partners, and the general public. Critical to ongoing lead abatement work and often a bottleneck in remediation work, especially during COVID-19 staffing issues, Flint Lead Free members have also contributed lead elimination workforce development.

Lead Education

Genesee Health System conducted lead education trainings in August and October 2018. Each five-hour training day had two parts: the first was open to the community and focused on how to use filters correctly, how to communicate about filter use, information about sources of lead and the Lead Safe Home Program, and other environmental hazards; the second served as a train-the-trainer session to instruct Community Health Workers (CHWs) and other participants how to effectively communicate gained knowledge and skills. Between the two training courses, 150 people were trained, 135 of whom were CHWs working directly with Flint families, and several were from the Flint Registry.

Additionally, Flint Lead Free and the Flint Healthy Homes groups amplified a community campaign on lead testing for children after the start of the COVID-19 pandemic. Social media messages and brochures were shared with partners to help get the message to Flint community members about the continued importance of having children's blood lead screened as recommended, as the screening rates dropped significantly after the start of the COVID-19 pandemic.

Finally, during annual National Lead Poisoning Prevention Weeks, information on webinars, toolkits, and education were shared with workgroup members, and members were encouraged to share this information with their wider networks. Trainings for lead safe work programs, other community lead-related trainings, and lead-related updates were also shared when appropriate.

Lead Training, Accreditation, and Workforce Development

The Michigan Department of Health and Human Services (MDHHS), Healthy Homes Section is the EPA-authorized entity for the state of Michigan to administer lead training, accreditation, and enforcement for lead training providers, lead professionals, and firms. Additionally, the Healthy Homes Section identifies gaps in the lead and construction workforce and develops initiatives to build workforce capacity.

The data below represents the number of individuals, statewide, receiving accreditation in a lead discipline, the number of individuals receiving training through the MDHHS lead training scholarship program, and the number of firms receiving lead abatement accreditation between January 1 and December 31 of the referenced calendar year.

Calendar Year	2018	2019	2020	2021
1. Total individuals certified statewide	1,724	1,775	1,285	1,318
2. Individuals trained through MDHHS lead training scholarship program statewide	127	70	49	81
3. Lead abatement firms certified statewide	221	160	193	186

Note: Data not available prior to 2018.

The Flint Registry

Primarily supported by the Centers for Disease Control and Prevention (CDC), the Flint Registry is a project that connects people to services and programs to promote health and wellness and helps reveal how the Flint water crisis has affected the Flint community. A resource for individuals who were exposed to lead-contaminated water, the Flint Registry screens enrollees for ongoing environmental lead exposure via a survey of environmental risks. Based on enrollee responses of ongoing lead exposure, the Flint Registry may refer individuals to Lead Safe Home Program and/or the City of Flint pipe replacement program. The Flint Registry also refers enrollees to secondary prevention resources (i.e. health, education, nutrition resources) to mitigate the impact of the lead exposure. The Flint Registry is for all individuals exposed to the Flint water crisis; however, the Flint Registry prioritizes efforts to enroll individuals who lived in a home with a lead/galvanized service line, children with blood lead levels > 5 µg/dL, and other vulnerable populations (i.e. all children) who would benefit from Flint Registry enrollment. In January 2019, the Flint Registry launched widespread public enrollment. By the end of 2021, the Flint Registry had enrolled over 18,000 individuals (12,404 adults and 5,614 children) exposed to the Flint water crisis and made over 20,000 connections to supporting programs. The Flint Registry continues to enroll individuals, as well as conduct long-term surveillance of enrollees. Enrollment information and continually updated data, including preliminary outcomes and resources for other communities with lead exposure, can be found at [FlintRegistry.org](https://flintregistry.org).

Flint Registry Referral Numbers

Calendar Year	2019	2020	2021	TOTAL
Referrals to Lead Safe Home Program	430	1,477	679	2,586
Referrals to City of Flint pipe replacement program	815	2,938	1,554	5,307
Other secondary prevention referrals	3,063	9,353	4,216	16,632

Patient Screening and Testing

Patient screening for lead exposure can occur as a series of questions that ask about environmental risk (i.e. age of home, hobbies, occupation, etc.) and/or blood lead screening. Results of screening often prompt further investigations, education, and connections to lead elimination services.

Greater Flint Health Coalition — Genesee CHAP OB/GYN Primary Prevention Lead Risk Screening Program

Starting in 2019, the Greater Flint Health Coalition's Genesee Community Health Access Program (CHAP) expanded to implement an OB/GYN Primary Prevention Lead Risk Screening Intervention. This program works to create a lead safe environment before a baby is born.

The program provides a locally relevant and evidence-based Lead Risk Screening Tool to prenatal providers in the Flint/Genesee County area. Currently, several OB/GYN offices and the Maternal and Infant Health Program use the tool to screen their pregnant patients. Since program inception, the top reasons for referral were a "Yes" or "Unsure" response to questions about living in a home built before 1978, living in a home built before 1978 that is currently being renovated or repaired, or water being tested and having a high lead level.

After referral, Genesee CHAP community-based nurses engage the expectant mother, providing lead education and connection to possible environmental lead remediation services (like the MDHHS Lead Safe Home Program), and offer other CHAP services, including those that address medical home access and the social determinants of health (e.g. food, transportation, car seats, safe sleep, pack and plays, insurance, WIC, MIHP services, and community resources). CHAP also provides feedback to referring providers regarding the outcome of services delivered by CHAP nurses.

Calendar year	2019	2020	2021
Total referrals after screening*	166	353	227
Screening referrals covered by Medicaid	138 (83%)	304 (86%)	204 (90%)
Referrals reasons fully resolved (i.e. lead education)	143 (86%)	322 (91%)	191 (84%)
Referral unable to be reached	21 (13%)	18 (5%)	34 (15%)
Referral declined	2 (1%)	7 (2%)	2 (1%)

*Note: There were additional referrals for patients who lived or received their OB care in Genesee County, but did not live in the City of Flint: 73 referrals in 2019, 165 additional referrals in 2020, and 178 additional referrals in 2021.

Blood Lead Testing & Results for Those Residing in Flint 2013-2021

Child blood lead testing in the State of Michigan is reported to the MDHHS Childhood Lead Poisoning Prevention Program (CLPPP). They are responsible for providing:

- Blood lead surveillance, data, and reports
- Lead poisoning education and outreach
- Support to local health departments to provide health services for children with elevated blood lead levels
- Health services for children at risk of lead poisoning
- Funding to local health departments and/or alternatives for Elevated Blood Lead Level (EBLL) nurse case management

Since May 1, 2016, children in Genesee County with a blood lead level (BLL) at or greater than 4.5 µg/dL have been referred to the Community Health Access Program EBLL Nurse Case Management Program managed by the Greater Flint Health Coalition. The goal of EBLL Nurse Case Management services is to bring every child's venous blood lead level below 4.5 µg/dL and prevent future EBLLs by overseeing the reduction or elimination of sources of lead (or potential sources of lead) in the child's environment. Nurse Case Management services support the child's continued health and safety, connect them with environmental, social, and medical services, and ensure coordination with their medical home and Medicaid Health Plan (as applicable).

For adults, the Michigan Adult Blood Lead Epidemiology Surveillance (ABLES) program works with MDHHS by collecting the results of blood lead testing, confirming diagnoses, and investigating exposure circumstances. The ABLES program is housed in the Occupational and Environmental Medicine Division of Michigan State University's College of Human Medicine.

Interpretation of Blood Lead Level Testing

Blood lead testing of children has been traditionally used as a detector of environmental contamination. High-risk children should be tested at 1 and 2 years of age during well-child doctor visits. These are the ages when children developmentally have strong hand-to-mouth behaviors and are most at risk for household lead exposure (paint, dust, etc.). High risk is designated by the CDC and American Academy of Pediatrics and includes risk factors such as age of home, Medicaid status, parental hobbies/occupation, etc. Blood lead testing for adults is done when the following occurs:



1) when/as required by Michigan OSHA regulations 1910.1025(j)(1)(i). The employer shall institute a medical surveillance program for all employees who are or may be exposed at or above airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8-hour period for more than 30 days per year; 2) when the patient or health care provider is concerned about possible exposure (e.g. hobby involving firearms); or 3) when the health care provider is concerned that the patient's symptoms indicate possible lead toxicity. Since the recommendation for blood testing is not universal and must be determined by an algorithm of risk factors or known/suspected exposure, blood lead testing rates are low and only capture a small segment of the population.

Blood lead testing only reflects recent and/or ongoing exposure to lead. With a short detection window in blood (half-life approx. 28 days), blood lead testing does not capture historic and/or cumulative lead exposure. In addition, blood lead surveillance programs (performed at the routine ages of 1 and 2 years) do not adequately reflect lead-in-water exposure, which burdens a younger and more developmentally vulnerable population.

Of note, following the widespread recognition of the Flint water crisis, there was expanded testing for blood lead levels (see increase in number of children tested in 2016). Although more children were noted to have BLLs > 4.5 and > 10 $\mu\text{g}/\text{dL}$, the percentage decreased because of the increased denominator.

In October 2021, the CDC announced a change in the blood lead reference value (BLRV), the level used to classify blood lead test result as an elevated blood lead level, from 5 $\mu\text{g}/\text{dL}$ (micrograms of lead per deciliter of blood) to 3.5 $\mu\text{g}/\text{dL}$. MDHHS adopted the new reference value on May 1, 2022. The new BLRV of 3.5 $\mu\text{g}/\text{dL}$ is included in the below tables.

Both 2020 and 2021 are unusual testing years. Blood lead testing throughout Michigan decreased markedly starting in February 2020, associated with the COVID-19 pandemic. The populations tested from 2020 to 2021 were likely different from those in previous years, and comparing results from this period to previous years should be done with caution.

For the following three tables examining blood lead levels, Flint residence is defined as "Flint" when it is listed as the residence from the collected address. Each person is included only once per year in annual counts and once per all years in the total. If a person had multiple tests in the year, the highest BLL from a venous test was counted. If no venous test was performed, the highest BLL from a capillary blood draw was counted. If the type of test was unknown, the highest BLL obtained from an unknown sample type was counted. An individual can be included in multiple tables as they age. For example, a child age 3 in 2015 would be age 8 in 2020 and thus be counted in both Tables 1 and 2 (ages less than 6 and 6-17, respectively).

Children who are less than 6 years residing in Flint, MI

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Estimated number of children*	9,558	9,119	9,020	8,784	8,549	8,543	8,344	8,200	6,996
Number tested	3,489	3,492	3,792	7,349	3,473	3,330	3,129	1,851	1,837
Percent tested	36.5	38.3	42.0	83.7	40.6	39.0	37.5	22.6	26.3
Number ≥ 3.5 $\mu\text{g/dL}$	205	250	213	351	224	169	166	41	42
Percent ≥ 3.5 $\mu\text{g/dL}$	5.9	7.2	5.6	4.8	6.4	5.1	5.3	2.2	2.3
Number ≥ 4.5 $\mu\text{g/dL}$	103	130	112	173	96	78	79	16	21
Percent ≥ 4.5 $\mu\text{g/dL}$	3.0	3.7	3.0	2.4	2.8	2.3	2.5	0.9	1.1
Number ≥ 9.5 $\mu\text{g/dL}$	17	21	21	39	21	15	13	***	6
Percent ≥ 9.5 $\mu\text{g/dL}$	0.5	0.6	0.6	0.5	0.6	0.5	0.4	***	0.3

*Based on American Community Survey 5-year estimates from the US Census Bureau. ***Counts between 1 and 5 have been suppressed to protect confidentiality.

Children who are 6-17 years residing in Flint

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number tested	583	428	1,166	7,930	1,800	1,250	928	511	557
Number ≥ 3.5 $\mu\text{g/dL}$	8	8	18	100	24	16	10	***	***
Percent ≥ 3.5 $\mu\text{g/dL}$	1.4	1.9	1.5	1.3	1.3	1.3	1.1	***	***
Number ≥ 4.5 $\mu\text{g/dL}$	***	6	8	45	15	7	6	***	***
Percent ≥ 4.5 $\mu\text{g/dL}$	***	1.4	0.7	0.6	0.8	0.6	0.6	***	***
Number ≥ 10 $\mu\text{g/dL}$	***	***	***	8	***	***	***	***	***
Percent ≥ 10 $\mu\text{g/dL}$	***	***	***	0.1	***	***	***	***	***

***Counts between 1 and 5 have been suppressed to protect confidentiality.

Adults residing in Flint

Calendar Year	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number tested	148	127	853	16,880	3,506	2,827	2,163	1,180	952
Number ≥ 3.5 $\mu\text{g/dL}$	20	15	33	458	98	47	34	12	19
Percent ≥ 3.5 $\mu\text{g/dL}$	13.5	11.8	3.9	2.7	2.8	1.7	1.6	1.0	2.0
Number ≥ 5 $\mu\text{g/dL}$	16	13	22	260	60	26	18	12	14
Percent ≥ 5 $\mu\text{g/dL}$	10.8	10.2	2.6	1.5	1.7	0.9	0.8	1.0	1.5
Number ≥ 10 $\mu\text{g/dL}$	7	***	***	47	12	7	***	***	***
Percent ≥ 10 $\mu\text{g/dL}$	4.7	***	***	0.3	0.3	0.2	***	***	***

*** Counts between 1 and 5 are not reported (replaced with *** in the table above). Other counts are also not reported if they can be used to calculate the suppressed counts. This is done to protect the privacy of people who had a blood lead test.

For additional information on Flint adult blood lead results, please see this website to access blood lead level surveillance reports: <https://oem.msu.edu/index.php/annual-reports>.

Economic Analysis of Lead Elimination Activities

From decreased economic productivity to added health care, education, and criminal justice expenses, the societal costs of preventable lead exposure are great. A report by Pew and Robert Wood Johnson Foundation noted an estimated potential benefit of \$84 billion annually from eliminating lead exposure in the United States. Using data from Altarum's Value of Health tool, prior studies, and data from valueofleadprevention.org, **the combined future economic benefits for Flint and its residents from lead service line replacements, home abatements, and demolitions completed from 2013 through 2021 are expected to amount to \$201.8 million.** These benefits include the impacts of reduced lead exposure for Flint children, and the resulting long-term impacts on health, lifetime earnings, and longevity, plus the financial benefits of demolishing distressed structures. The benefits from lead service line replacements and home abatements are estimated conservatively, measuring the impacts only for newborn children, while the economic value of demolitions are calculated based on the estimated financial impacts on real estate markets.

Note: Above calculations incorporate data/information from the following sources: 1) Data from Altarum's analysis of the economic benefits from lead service line replacements in Michigan (currently undergoing peer-review); 2) Griswold et al (2015). Estimating the Effect of Demolishing Distressed Structures in Cleveland, OH, 2009-2013. Griswold Consulting Group. Last accessed 12/20/2022: https://case.edu/socialwork/povertycenter/sites/case.edu.povertycenter/files/2018-09/FinalReportwithExecSummary_modified.pdf; 3) Data for the State of Michigan on Lead Hazard Control interventions from: valueofleadprevention.org.

Challenges & Successes

This Flint Lead Free report attempts to quantify lead-related activity in Flint over time. Although data challenges exist, including a time lag for obtaining the numbers, the yearly trends reveal an unprecedented, coordinated, and growing multi-sector effort to decrease children's lead exposure burden. With an emphasis on primary prevention, sources of lead are being identified and eliminated before children are unnecessarily exposed. And as such, there is a quantifiable societal economic benefit. While there is significant primary prevention activity taking place in Flint, the worldwide COVID-19 pandemic resulted in a decrease in blood lead screening, a pause in many home inspections and abatements, and a delay in lead pipe replacements.

The greatest challenge in Flint Lead Free's efforts to decrease the burden of environmental lead exposure has been the global COVID-19 pandemic. Throughout this report, the data reveal COVID-19's deep and lingering impacts on lead-related outreach, community engagement, referrals, pipe removal, home inspections and abatements, and lead screenings.

The pandemic has also created unexpected opportunities. While exposing chronic disinvestment in public health infrastructure and ongoing systemic health inequities, the response to the pandemic has garnered additional resources for lead elimination. The 2021 American Rescue Plan Act (ARPA) distributed \$240 billion to state and local governments. Eligible uses of these funds include a broad range of water and sewer infrastructure investments, including remediation of lead paint or other lead hazards. The City of Flint received an allocation of \$94.7 million, which must be obligated by December 31, 2024, and expended by December 31, 2026. Flint Lead Free with Flint Healthy Homes sent Flint's Mayor Neely and the Flint City Council letters/emails advocating and recommending evidence-based lead-mitigating actions with the use of some of the ARPA funding. Following several community engagement sessions, resident survey, and review of evidence-based interventions, the City of Flint proposed an ARPA budget and plan that was later amended and approved by the Flint City Council in

October 2022. The final ARPA budget includes \$5 million in Community Grants to support the broad category of Home Repair and Improvement grants. This allocation of funds to support a broad range of home repairs can support lead remediation efforts by expanding existing programs or implementing innovative approaches to address lead exposure in homes. The competitive grant process for City of Flint ARPA grant programs will begin in 2023. There are also additional state ARPA resources that could be leveraged for lead elimination. It is expected Flint Lead Free will report on any ARPA-funded lead primary prevention programs in the 2024 edition of the Flint Lead Free report.

Nationally, the Bipartisan Infrastructure Law (Infrastructure Investment and Jobs Act) was passed in November of 2021. This expansive Bipartisan Infrastructure Law includes improvements to much of the infrastructure of the United States. It includes approximately \$3 billion for lead service line replacement to states, tribes, and territories, prioritizing underserved communities. Members of Flint Lead Free have been instrumental in sharing Flint's story to proactively eliminate all lead service lines. These investments in service line replacement are an example of how Flint is leading the way in lead elimination projects that can and should be expanded to communities across the country.

Another success during this reporting period was the publication of a manuscript that highlighted lessons learned after the first year of compliance water sampling under Michigan's revised Lead and Copper Rule. Authored by Flint Lead Free members, this manuscript, published in the American Water Works Association (AWWA) *Water Science* journal in December 2021 was aptly titled, "Lessons from the first year of compliance sampling under Michigan's revised Lead and Copper Rule and national Lead and Copper Rule implications." The published article won the 2021 AWWA Water Quality & Technology Division Best Paper Award and was the 2022 recipient of the AWWA Publications Award.

Conclusion

Over the next two years, Flint Lead Free will continue to identify and engage relevant stakeholders to ensure appropriate voices are included in strategic conversations. Flint Lead Free and Flint Healthy Homes will continue to work collaboratively to track and update primary prevention programs and services, lead elimination data, and lead-related training opportunities. Future reports hope to include mapping to better visualize other lead sources and target lead elimination efforts, as well as provide updated economic benefits of lead elimination. Flint Lead Free recognizes and will continue to work to overcome ongoing challenges to achieving lead elimination such as chronic disinvestment, workforce development and competitive compensation, awareness of and trust in programs, wait time for abatement, sustainability of resources, and the creation and enforcement of stronger codes and regulations.

Despite our best efforts, the legacy of lead lingers disproportionately in the environments of our most vulnerable children. The use of lead in paint, plumbing, gasoline, and other applications was widespread and continued for decades despite its potent toxicity. Resources need to be substantially increased, especially considering COVID-19's impact, to continue to advance Flint Lead Free's lead elimination efforts and to share best practices with similarly impacted communities.

We look forward to continuing this positive and proactive work with our many partners.

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