

Progress Report on the Federal Lead Action Plan: December 2018-April 2024



List of Acronyms

AAPI	Asian American and Pacific Islander
ATSDR	Agency for Toxic Substances and Disease Registry
BIL	Bipartisan Infrastructure Law
BLL	Blood Lead Level
BLRV	Blood Lead Reference Value
CASAC	Clean Air Scientific Advisory Committee
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CDC	Centers for Disease Control and Prevention
CLPPP	Childhood Lead Poisoning Prevention Program
CoP	Community of Practice
CORE	Commitment to Health Equity
CPSC	U.S. Consumer Product Safety Commission
DOJ	U.S. Department of Justice
DOL	U.S. Department of Labor
DLCL	Dust-lead Clearance Levels
DLHS	Dust-lead Hazard Standards
DWSRF	Drinking Water State Revolving Fund
DWINSAs	Drinking Water Infrastructure Needs Survey and Assessment
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FDA	U.S. Food and Drug Administration
GAAR	Greater Albuquerque Association of Realtors
HAP	Hazardous Air Pollutant
HHS	United States Department of Health and Human Services
HUD	U.S. Department of Housing and Urban Development
ICDDR	International Centre for Diarrheal Disease Research
IRP	Integrated Review Plan
ISA	Integrated Science Assessment
LEPAC	Lead Exposure and Prevention Advisory Committee
Mg	Milligram
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration

NESHAP	National Emissions Standard for Hazardous Air Pollutants
NIEHS	The National Institute of Environmental Health Sciences
NSPS	New Source Performance Standards
OASH	Office of the Assistant Secretary for Health
OSHA	Occupational Safety and Health Administration
Pb	Lead (Elemental heavy metal)
PEHSU	Pediatric Environmental Health Specialty Unit
PLEA	Preventing LEad Exposure in Adults
ppm	Parts per million
PTF	President's Task Force
RCRA	Resource Conservation and Recovery Act
RRP	Renovation, Repair and Painting
SDWA	Safe Drinking Water Act
SoilSHOP	Soil Screening, Health, Outreach and Partnership
TSCA	Toxic Substances Control Act
USAID	U.S. Agency for International Development
USDA	U.S. Department of Agriculture
WIC	Women, Infants, and Children
WIFIA	Water Infrastructure Finance and Innovation Act
WTP	Worker Training Program
3Ts	Training, Testing and Taking Action

Table of Contents

List of Acronyms	ii
Table of Contents.....	iv
Introduction.....	1
Goal 1: Reduce Children’s Exposure to Lead Sources	2
Objective 1.1. Reduce Children’s Exposure in Homes and Child-Occupied Facilities with Lead-Based Paint Hazards.....	3
Objective 1.2. Reduce Exposure to Lead from Drinking Water	7
Objective 1.3. Reduce Exposure to Lead in Soil	11
Objective 1.4. Reduce Exposure to Lead Associated with Emissions to Ambient Air	14
Objective 1.5. Reduce Lead Exposure from Occupational Sources.....	16
Objective 1.6. Reduce Exposure to Lead in Food	17
Objective 1.7. Reduce Exposure to Lead in Cosmetics and Personal Care Products	18
Objective 1.8. Reduce Exposure to Lead in Consumer Products	19
Objective 1.9. Reduce Lead Exposure Through Enforcement and Compliance Assistance	20
Goal 2: Identify Lead-Exposed Children and Improve Their Health Outcomes.....	26
Objective 2.1. Improve Surveillance of Blood Lead Levels (BLLs) to Identify Children Exposed to Lead.....	27
Objective 2.2. Facilitate Follow-up Blood Lead Testing and Monitoring of Children Identified as Lead-Exposed	29
Objective 2.3. Facilitate Screening for Developmental Delays in Children Identified as Lead-Exposed	30
Objective 2.4. Facilitate Referrals and Receipt of Appropriate Services for Children Identified as At-Risk for Developmental Delays Due to Lead Exposure.....	30
Goal 3: Communicate More Effectively with Stakeholders	31
Objective 3.1. Consolidate and Streamline Federal Lead-Related Communication and Messaging	32
Objective 3.2. Improve Awareness of Lead Hazards, Prevention and Remediation Among Diverse Populations, Especially Those Most at Risk.....	34

Goal 4: Support and Conduct Critical Research to Inform Efforts to Reduce Lead Exposures and Related Health Risks 37

 Objective 4.1. Conduct and Collaborate on Research to Support Federal Lead Action Plan Goals 38

 Objective 4.2. Establish the Lead Exposure and Prevention Advisory Committee (LEPAC)..... 39

Moving Forward 39

Appendix 1: Acknowledgements 40

Appendix 2: U.S. EPA Lead Publications 2019-2024 41

Introduction

In December 2018, the President’s Task Force on Environmental Health Risks and Safety Risks to Children (Task Force) released a *Federal Lead Action Plan to Reduce Childhood Lead Exposures and Associated Health Impacts* (Federal Lead Action Plan).^{1, 2} The Federal Lead Action Plan serves as a blueprint for reducing lead exposure and associated harms through collaborations among federal agencies with a range of stakeholders. The development of the Federal Lead Action Plan was also informed by the *Key Federal Programs to Reduce Childhood Lead Exposures and Eliminate Associated Health Impacts* report that the Task Force released in 2016.³ The Task Force is a focal point for federal collaboration to promote and protect children’s environmental health and safety. Established in 1997 by Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks, the Task Force includes departments and agencies across the federal government.⁴

This document serves as a high-level Federal Lead Action Plan progress update where select accomplishments are highlighted.

The Federal Lead Action Plan aimed to achieve four goals:

- Reduce children’s exposure to lead sources.
- Identify lead-exposed children and improve their health outcomes.
- Communicate more effectively with stakeholders.
- Support and conduct critical research to inform efforts to reduce lead exposures and related health risks.

The Federal Lead Action Plan promotes a vision that the United States will become a place where children, especially those in communities with environmental justice concerns, can live, learn and play and be protected from lead exposure and its harmful effects. With a focus on populations disproportionately affected by lead exposure, the Federal Lead Action Plan strengthens federal efforts to advance environmental justice, including through implementation of Executive Order 14096: Revitalizing Our Nation’s Commitment to Environmental Justice for All, and Executive Order 14008: Tackling the Climate Crisis at Home and Abroad.^{5, 6} These Executive Orders call upon each federal agency to incorporate environmental justice into their missions and consider measures to address and prevent disproportionate and adverse environmental and health impacts on communities and better protect overburdened communities from pollution and environmental harm.

¹ <https://ptfcehs.niehs.nih.gov/>.

² https://ptfcehs.niehs.nih.gov/sites/niehs-ptfkeh/files/resources/lead_action_plan_508.pdf.

³ https://ptfcehs.niehs.nih.gov/sites/niehs-ptfkeh/files/features/assets/files/key_federal_programs_to_reduce_childhood_lead_exposures_and_eliminate_associated_health_impactspresidents_508.pdf.

⁴ <https://www.govinfo.gov/content/pkg/FR-1997-04-23/pdf/97-10695.pdf>.

⁵ <https://www.federalregister.gov/documents/2023/04/26/2023-08955/revitalizing-our-nations-commitment-to-environmental-justice-for-all>; <https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad>.

⁶ This report refers to communities facing disproportionate exposure to lead by various terms that have a variety of meanings (e.g., “disadvantaged,” “underserved,” “overburdened,” and “communities with environmental justice concerns”) depending on the community and the context, activity, and agency leading intervention efforts. Please refer to the specific activity announcements for information on the referenced communities.



Goal 1:
Reduce Children’s Exposure to Lead Sources

Key Priorities: Reduce children’s exposure to lead-based paint, lead-contaminated drinking water and lead-contaminated soil.

Impact: Federal efforts can further reduce childhood lead exposures by employing multiple coordinated approaches that include strengthening standards, enhancing prevention and control measures, and implementing long-lasting infrastructure improvements.

Objective 1.1. Reduce Children’s Exposure in Homes and Child-Occupied Facilities with Lead-Based Paint Hazards

Guidance and Regulations for Residential Lead: Several federal agencies amended standards and guidance to strengthen regulations for residential lead levels.

- In January 2024, the U.S. Environmental Protection Agency (EPA) lowered the recommended screening levels and strengthened guidance for investigating and cleaning up lead-contaminated soil in residential areas. These actions will likely result in more residential properties being identified for thorough cleanups.⁷
- In August 2023, EPA announced a proposal to strengthen regulations under the Toxic Substances Control Act (TSCA) by further revising the Dust-Lead Hazard Standards, and the Dust-Lead Post Abatement Clearance Levels. Together, if finalized, these regulations would reduce the potential lead exposures of approximately 250,000 to 500,000 children under age six per year.⁸
- In recent years, EPA took action to strengthen the following standards:
 - **Dust-Lead Hazard Standards:** In 2019, EPA finalized regulations to strengthen dust-lead hazard standards, which identify hazardous lead in dust on floors and windowsills in pre-1978 housing and child-occupied facilities.⁹ The U.S. Department of Housing and Urban Development (HUD) and the Centers for Disease Control and Prevention (CDC) provided technical information that informed the updated standards.



- **Dust-Lead Post Abatement Clearance Levels:** In 2021, EPA finalized regulations to strengthen the post-abatement dust lead clearance levels, which are the amounts of lead that can remain in dust on floors, windowsills and window troughs after lead removal activities, in pre-1978 housing and child-occupied facilities.¹⁰

⁷ <https://www.epa.gov/newsreleases/biden-harris-administration-strengthens-safeguards-protect-families-and-children-lead>

⁸ <https://www.epa.gov/newsreleases/biden-harris-administration-proposes-strengthen-lead-paint-standards-protect-against>.

⁹ <https://www.federalregister.gov/documents/2019/07/09/2019-14024/review-of-the-dust-lead-hazard-standards-and-the-definition-of-lead-based-paint>

¹⁰ <https://www.federalregister.gov/documents/2021/01/07/2020-28565/review-of-dust-lead-post-abatement-clearance-levels>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

Grant Activities: Several federal agencies implement grant programs to reduce lead-based paint hazards.

- **Supporting Communities to Reduce Lead Poisoning:** In September 2023, CDC awarded 11 grants under a new Notice of Funding Opportunity, Supporting Communities to Reduce Lead Poisoning.¹¹ Funded recipients will help families avoid the dangers of lead in their homes through community engagement, prevention education, and family support.
- **Lead Hazard Reduction Grants:** Between 2019 and 2024, HUD awarded over \$800 million to state and local governments to make homes of low-income families safe from lead-based paint hazards.¹² Most of these funds are for treating homes that do not receive HUD housing assistance.¹³ In 2019, 2021, and 2023, HUD also executed \$122 million in Lead-Based Paint Capital Fund grants to public housing agencies to control these hazards in public housing units, where low-income families reside.^{14, 15, 16}
- **Lead Hazard Reduction Capacity Building Grants:** In April 2024, HUD awarded Lead Hazard Reduction Capacity Grants, an innovative approach developed to expand the capacity of state and local governments that have not received Lead Hazard Reduction grants to make homes of low-income families safe from lead-based paint hazards.¹⁷

Public Trainings and Outreach: Several federal agencies continue to provide trainings and outreach to the public to protect communities from lead-based paint hazards.

- **Lead Awareness Curriculum:** Between October 2021 and December 2023, the EPA hosted Lead Awareness Curriculum sessions for more than 3,000 individuals.¹⁸ Over 1,800 community members participated in “Understanding Lead” sessions and almost 1,200 community leaders participated in Train-the-Trainer sessions. These sessions helped to improve public understanding of lead exposure prevention actions and drive consumer demand for lead-safe certified contractors.
- **Lead-based Paint Technical Workshop:** In November 2023, EPA and HUD held a virtual public workshop to receive stakeholder input on the detection, measurement, and characterization of lead-based paint to support efforts to reduce lead exposure.¹⁹ Information received during the workshop will inform a joint effort to revisit the federal definition of lead-based paint and propose and finalize a revised definition, if necessary.²⁰



¹¹ <https://www.cdc.gov/nceh/lead/news/nofo-june-2023.html>.

¹² https://www.hud.gov/press/press_releases_media_advisories.

¹³ [https://uscode.house.gov/view.xhtml?req=\(title:42%20section:4852%20edition:prelim\)](https://uscode.house.gov/view.xhtml?req=(title:42%20section:4852%20edition:prelim)).

¹⁴ <https://archives.hud.gov/news/2019/pr19-124.cfm>.

¹⁵ <https://archives.hud.gov/news/2021/pr21-083.cfm>.

¹⁶ https://www.hud.gov/press/press_releases_media_advisories/HUD_No_23_193.

¹⁷ https://www.hud.gov/press/press_releases_media_advisories/HUD_No_24_074.

¹⁸ <https://www.epa.gov/lead/community-lead-awareness-sessions>.

¹⁹ <https://www.epa.gov/newsreleases/epa-and-hud-seeking-presenters-virtual-workshop-revisiting-definition-lead-based-paint>.

²⁰ EPA uses the definition in its Lead Renovation, Repair and Painting program and Lead-Based Paint Activities program, and HUD, in its Lead Safe Housing Rule program and Lead Hazard Reduction grant program. Both agencies use the definition in their jointly issued and enforced Lead Disclosure Rule.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- **National Standards for the Physical Inspection of Real Estate:** HUD developed and published a new process by which it examines the conditions of HUD-assisted multifamily properties and public housing properties, its National Standards for the Physical Inspection of Real Estate, that prioritizes health, safety, and functional defects in inspected properties. The presence of significant lead-based paint hazards is categorized as a “life-threatening condition” under this inspection process.
 - For HUD-assisted multifamily properties rated below a specified threshold score, if the housing is target housing, the office that manages the program refers the property to the Department’s lead safety program office for review of the property’s lead safety elements. For HUD-assisted public housing, the office that manages the public housing program monitors and verifies ongoing compliance by the public housing agencies, and consults with the lead safety program office as appropriate.
 - Since 2021, HUD has reviewed over 70 low-scoring multifamily properties with approximately 5,000 target housing units for their lead-based paint documentations regarding requirements under HUD’s Lead Safe Housing Rule (LSHR). The review found that most units were lead-based paint free (because of the age of the units), with most free of lead-based paint hazards. The units that were not lead-based paint free had new evaluations (risk assessments) were required to be conducted by the owners through certified lead risk assessors. Based on the risk assessments, HUD required, under the LSHR, interim control or abatement of all lead-based paint hazards identified.
 - For HUD-assisted public housing that is target public housing, the relevant office is reviewing existing lead-based paint inspection and risk assessment reports, both of which are required to have been conducted by the public housing agencies under the LSHR. When records are missing or are deemed inadequate, PIH is requiring the public housing agencies to update their records by conducting new lead-based paint inspections and/or risk assessments.
 - Since 2019, HUD has reviewed lead records of 849 assisted public housing properties totaling over 177,000 housing units for conformance with Lead Disclosure Rule requirements, and, after checking for exemptions from the rule (for properties for persons with disabilities and properties for the elderly), reviewed the records of over 133,000 units for conformance with the LSHR. When the reports were found not to be in compliance with the respective rules, HUD required the public housing agencies to both conduct new lead-based paint inspections and/or risk assessments and update their lead-based paint management plans.
- **Renovation, Repair and Painting (RRP) Program:** EPA’s RRP program applies to firms that disturb painted surfaces for compensation in homes and child-care facilities built before 1978. RRP requires that these firms be certified, their employees trained and that they follow prescribed lead-safe work practices. In 2023, EPA’s Lead-based Paint Professional Locator listed nearly 80,000 RRP certified firms nationally.²¹

²¹ <https://cdxapps.epa.gov/ocspp-oppt-leadhub/firm-location-search>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- **Lead Paint Awareness Advertisement Campaign:** In 2023, EPA ran a lead paint awareness advertisement campaign in buses and bus shelters for twelve weeks in Reading, Pennsylvania; Charlestown, West Virginia; Washington, D.C.; and Richmond, Virginia.²²
- **Lead Safe Housing Rule:** Between 2019 and 2023, HUD provided virtual training on the Lead Safe Housing Rule and its amendment on elevated blood lead levels to more than 2,500 individuals and firms who conduct lead-based paint inspections, risk assessments, abatement, and interim controls.
- **Real Estate Agent Training:** In January 2020, EPA was invited to conduct outreach to over 200 real estate agents in Albuquerque, NM. Topics included the Lead Paint Disclosure Act; the Lead Abatement Rule; and the RRP program, focusing on the regulatory requirements of the realty industry and what real estate agents and investors need to know about “flipping” houses. EPA distributed the “Lead-Safe Certified Guide to Renovate Right” brochure.²³
- **Lead Regulations Hotline:** HUD advertised the availability of its phone- and email-based Lead Regulations hotline on its website²⁴ and in its lead safety training materials for property owners and managers, the HUD-EPA-CPSC Lead Disclosure Regulation pamphlet, the EPA-HUD RRP Rule pamphlet, and additional outreach materials. From 2019 through early 2024, HUD received over 800 public inquiries, requests for information, and complaints about potential lead safety violations in housing. HUD followed up on complaints with the housing owners, local building and/or health code officials, and, when appropriate other federal, state and/or local agencies for review regarding their laws and regulations.



Global Alliance to Eliminate Lead Paint: EPA continues to engage internationally through the Global Alliance to Eliminate Lead Paint by reviewing draft laws to phase out lead paint and informing how to enforce those laws.²⁵

²² EPA regional offices are engaging in some region-specific projects, initiatives, or activities locally that advance the goals of the national plan, in particular areas in their regions that are facing risks or impacts from lead. Please refer to the specific activity announcements for information on geographically supported communities.

²³ <https://www.epa.gov/lead/lead-safety-documents-and-outreach-materials>.

²⁴ https://www.hud.gov/program_offices/healthy_homes/leadinfo.

²⁵ <https://www.epa.gov/international-cooperation/epa-leadership-lead-paint-alliance>.

Objective 1.2. Reduce Exposure to Lead from Drinking Water

Lead Service Line Replacement: Through the Bipartisan Infrastructure Law (BIL), departments and agencies will provide funding and technical support to communities to replace lead service lines.²⁶

- The Bipartisan Infrastructure Law provided \$15 billion in funding specifically dedicated for replacing lead service lines, along with an additional \$11.7 billion in general-purpose funding through the Drinking Water State Revolving Fund (DWSRF), which can also be used for lead pipe replacement. This includes funding to programs that are part of President Biden’s Justice40 Initiative which sets the goal that 40 percent of the overall benefits of certain Federal climate, clean energy, affordable and sustainable housing, and other investments flow to disadvantaged communities that are marginalized by underinvestment and overburdened by pollution.²⁷
- EPA has announced \$9 billion of this funding dedicated to lead pipe replacement, and replacements are now underway in communities nationwide.
- The BIL mandates that 49% of funds provided through EPA’s DWSRF General Supplemental Funding and DWSRF Lead Service Line Replacement Fund must be provided to disadvantaged communities as grants or forgivable loans.²⁸ In April 2023, EPA announced the availability of over \$6.5 billion through the DWSRF for states, Tribes and territories for essential drinking water infrastructure upgrades. This new funding, boosted by the Bipartisan Infrastructure Law, will help ensure communities have access to clean and safe drinking water.
- In August 2023, the U.S. Department of Agriculture (USDA) announced \$78 million in new grants to remediate lead pipes.²⁹ These funds will help ensure that rural communities have the funds they need to access clean and safe drinking water.
- From January 2021 to October 2023, EPA provided more than \$440 million in technical assistance to help systems that serve disadvantaged communities begin removal of lead service lines, protecting the health of over 5.5 million people.



²⁶ <https://www.whitehouse.gov/briefing-room/statements-releases/2023/11/30/fact-sheet-biden-harris-administration-announces-new-action-to-protect-communities-from-lead-exposure/>.

²⁷ https://www.whitehouse.gov/wp-content/uploads/2023/11/Justice40-Initiative-Covered-Programs-List_v2.0_11.23_FINAL.pdf.

²⁸ https://www.epa.gov/system/files/documents/2022-03/combined_srf-implementation-memo_final_03.2022.pdf.

²⁹ <https://www.usda.gov/media/press-releases/2023/08/28/biden-harris-administration-announces-more-800-million-strengthen>.

Lead and Copper Rule Improvements:

In November 2023, EPA announced proposed improvements to the Lead and Copper Rule to better protect communities from lead in drinking water. The proposed rule, if finalized, would be a major advancement in protecting children and adults from the significant, and irreversible, health effects from exposure to lead in drinking water. The proposed rule would require the vast majority of lead pipes in the U.S. to be replaced within 10 years, water systems to locate legacy lead pipes and replace lead service lines, improve tap sampling, lower the lead action level, and strengthen protections to reduce exposure.³⁰



Get the Lead Out Initiative: In November 2023, EPA launched the Get the Lead Out Initiative, which sets out a partnership with 200 underserved and disadvantaged communities nationwide to provide the technical assistance to access funding from the Bipartisan Infrastructure Law and to remove lead service lines.³¹ This initiative builds on EPA and the Department of Labor’s (DOL) partnership with 40 underserved communities to support lead pipe replacement.

Low-Cost Loans Under the Water Infrastructure Finance and Innovation Act (WIFIA): EPA’s WIFIA program accelerates investment in our nation’s water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects.³² As of November 2023, EPA’s WIFIA and DWSRF programs provided over \$796 million to help water systems that serve disadvantaged communities begin removal of lead service lines across the country, protecting the health of over 9.8 million people.³³ Two highlights of these important investments:

- In November 2023, EPA announced a \$336 million loan to the City of Chicago. This financing will help Chicago, which has one of the highest concentrations of lead pipes in the nation, to replace up to 30,000 lead service lines while creating an estimated 2,700 jobs.³⁴
- In February 2023, EPA announced a \$340 million loan to the City of Philadelphia.³⁵ An initial investment of nearly \$20 million will modernize critical drinking water infrastructure by replacing approximately 160 lead service lines and 15 miles of water mains affecting 1.6 million people throughout the city.

³⁰ <https://www.epa.gov/ground-water-and-drinking-water/proposed-lead-and-copper-rule-improvements>.

³¹ <https://www.epa.gov/water-infrastructure/get-lead-out-initiative>.

³² <https://www.epa.gov/wifia>.

³³ <https://www.whitehouse.gov/briefing-room/statements-releases/2023/11/30/fact-sheet-biden-harris-administration-announces-new-action-to-protect-communities-from-lead-exposure/#:~:text=In%20total%20during%20this%20administration%2C%20EPA%E2%80%99s%20Water%20Infrastructure,protecting%20the%20health%20of%20over%209.8%20million%20people>.

³⁴ <https://www.epa.gov/newsreleases/biden-harris-administration-announces-336-million-loan-chicago-help-remove-30000-lead>.

³⁵ <https://www.epa.gov/newsreleases/biden-harris-administration-announces-340-million-water-infrastructure-and-lead-pipe>.

Updating EPA’s Drinking Water Infrastructure Needs Survey and Assessment (DWINSA):

In September 2023, EPA published its updated DWINSA, which, for the first time, included an estimate of the number of lead service lines per state.³⁶ This important data informs EPA’s allocation of the DWSRF, including the lead-specific BIL funding, to ensure that funding is focused on states with the greatest need to remediate lead service lines.



Water Infrastructure Improvements for the Nation Act: In July 2023, EPA announced \$58 million in grant funding from President Biden’s Investing in America agenda to protect children from lead in drinking water at schools and childcare facilities across the country.³⁷

Drinking Water Consumer Reports: In March 2023, EPA announced a proposed rule that would strengthen the annual Consumer Confidence Report requirements, making drinking water quality and health information more accessible to residents and businesses across the country and clarifying information regarding lead levels and efforts to reduce lead in drinking water.^{38, 39}

Training, Testing, and Taking Action (3Ts) for Reducing Lead in Drinking Water: EPA continues to publish technical and outreach materials under the 3Ts Guidance, a comprehensive resource for schools and childcare facilities implementing a lead testing and remediation in drinking water program. The guidance is available in English and Spanish.⁴⁰

- In March 2023, EPA and the U.S. Department of Health and Human Services (HHS) issued a joint letter to governors to encourage state and local governments to use federal funding to reduce and remove lead in drinking water in early care and education settings, like elementary schools and daycare facilities.⁴¹

³⁶ <https://www.epa.gov/dwsrf/epas-7th-drinking-water-infrastructure-needs-survey-and-assessment>

³⁷ <https://www.epa.gov/newsreleases/biden-harris-administration-announces-58-million-reduce-lead-schools-and-childcare>.

³⁸ <https://www.epa.gov/newsreleases/epa-announces-proposal-improve-public-awareness-drinking-water-quality>.

³⁹ A Consumer Confidence Report, sometimes called an “Annual Drinking Water Quality Report,” summarizes information about the local drinking water for the previous year. EPA’s proposal would support public education by more clearly communicating important information in water quality reports and improving access to the reports.

⁴⁰ <https://www.epa.gov/ground-water-and-drinking-water/3ts-reducing-lead-drinking-water>.

⁴¹ <https://www.epa.gov/newsreleases/epa-and-hhs-encourage-states-utilize-federal-resources-lead-detection-and-mitigation>.

Lead Service Line Replacement Accelerators: In January 2023, EPA announced the Lead Service Line Replacement Accelerators Initiative, which will provide targeted technical assistance services to help underserved communities access funds from the BIL and replace lead pipes that pose health risks to children and families.⁴² EPA and four state partners—Connecticut, New Jersey, Pennsylvania and Wisconsin—are working with 40 communities to address existing barriers and accelerate progress towards lead service line identification and replacement.⁴³



Guidance for Developing and Maintaining a Service Line Inventory:

Between August 2022 and March 2023, EPA conducted nine outreach events to states, water systems, and the National Tribal Council on the new “Guidance for Developing and Maintaining a Service Line Inventory.”⁴⁴ The guidance will help water systems develop lead service line inventories and begin replacement programs. These included webinars, presentations, a Q&A session, and a roundtable session.

Safe Drinking Water Act Variance: In December 2019 and November 2022, EPA approved a Safe Drinking Water Act variance that allowed Denver Water’s combined use of alternative treatment, lead service line replacements, and customer filters to reduce lead exposure for the 1.4 million customers served. This approach will result in the removal of 64,000 lead service lines, protecting future generations of children.

Use of Lead Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water Rule: In September 2020, EPA published the final regulation, “Use of Lead Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water.”⁴⁵ EPA made conforming changes to existing regulations based on the Reduction of Lead in Drinking Water Act and the Community Fire Safety Act enacted by Congress. The final rule also requires that manufacturers or importers certify that their products meet the requirements using a consistent verification process within 3 years of the final rule publication date (September 2023). This new rule will reduce lead in drinking water and assure that states, manufacturers, inspectors, and consumers have a common understanding of lead-free plumbing.

⁴² <https://www.epa.gov/newsreleases/epa-launches-new-initiative-accelerate-lead-pipe-replacement-protect-underserved>.

⁴³ <https://www.epa.gov/water-infrastructure/lead-service-line-replacement-accelerators>.

⁴⁴ https://www.epa.gov/system/files/documents/2022-08/Inventory%20Guidance_August%202022_508%20compliant.pdf.

⁴⁵ <https://www.federalregister.gov/documents/2020/09/01/2020-16869/use-of-lead-free-pipes-fittings-fixtures-solder-and-flux-for-drinking-water>.

Objective 1.3. Reduce Exposure to Lead in Soil



Cleanup Projects: Agencies continued to manage lead contamination at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, commonly known as “Superfund” sites), Resource Conservation and Recovery Act (RCRA) Corrective Action facilities and other sites to reduce exposure to community residents.

- **Brownfields Grantee Cleanups:** Lead is the most commonly reported environmental contaminant by EPA Brownfields cleanup grant recipients. In Fiscal Year 2023, Brownfields grant recipients completed 62 cleanups that addressed lead contamination, including in or near disadvantaged communities.
- **Superfund Cleanup Projects:** The Agency for Toxic Substances and Disease Registry (ATSDR) and EPA continued to work together to address lead contamination at Superfund and RCRA Corrective Action facilities to reduce community lead exposure. In Fiscal Year 2023, EPA completed 49 Superfund cleanup projects—including in or near disadvantaged communities—that addressed lead as a contaminant, which contributed to the Agency’s goal of completing 225 Superfund cleanup projects by September 30, 2026. Highlights from recent cleanups:
 - In February 2024, EPA announced more than \$1 billion for cleanup projects at more than 100 Superfund sites across the country.⁴⁶ This funding will launch cleanup projects at 25 Superfund sites and continue cleanup at over 85 Superfund sites, delivering on the Biden administration’s Justice40 Initiative, which sets a goal to deliver 40% of the overall benefits of certain federal investments to disadvantaged communities.
 - Between 2018 and 2023, EPA completed soil lead cleanups at more than 2,400 residential properties as part of Superfund cleanups in Colorado, Utah and Montana.
 - Between 2018 and 2023, EPA completed soil lead cleanups at 5,345 residential properties across 16 Superfund sites in Iowa, Kansas, Missouri, Nebraska, and nine Tribal nations. At

⁴⁶ <https://www.epa.gov/newsreleases/biden-harris-administration-announces-over-1-billion-start-new-cleanup-projects-and>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

the Omaha Lead Superfund Site, EPA remediated 460 properties and paint stabilized 125 properties.

- EPA and HUD worked together on the EPA/HUD proximity analysis and achieved successful results to identify and notify residents of HUD housing in Iowa, Kansas, Missouri, Nebraska, and nine Tribal nations. This included property owners at 838 total HUD properties within 12 different Superfund sites. Most sites were sampled and, if qualifying, remediated.

Soil Lead Guidance for Cleanup of Contaminated Soil: EPA and ATSDR continued to improve guidance documents used to effectively clean up lead-soil contamination. ATSDR is developing guidance for assessing blood lead data from children living near lead contaminated sites. ATSDR is also leading a federal workgroup developing health assessment guidance for evaluating environmental exposures to lead.

- In January 2024, EPA announced updates to guidance for lead in residential soil at Superfund sites and RCRA Corrective Action facilities.⁴⁷ The new residential soil lead guidance lowers the screening values for Superfund cleanup actions from 400 parts per million (ppm) to 200 ppm at most sites. In addition, for CERCLA remedial sites with aggregate lead exposures, or those with other known sources of lead exposure—such as lead in air and water—EPA will use a reduced screening level of 100 ppm. These updates to the 1994 guidance recognize the updated, best available science on the dangers of lead exposure and allow EPA to better protect children and communities.⁴⁸
- In 2023, EPA released the “EPA Region 7 Cleanup and Redevelopment Guide to Lead Mining and Smelting Sites,” which offers a set of tools and materials representing successful approaches to lead site cleanup in Iowa, Missouri, Kansas, Nebraska, and nine Tribal nations. It focuses on residential reuse and community properties, recreation and open space reuse, solar renewable energy, commercial reuse and community revitalization, and ecological revitalization.⁴⁹

⁴⁷ <https://www.epa.gov/superfund/updated-soil-lead-guidance-cercla-sites-and-rcra-corrective-action-facilities>.

⁴⁸ <https://www.epa.gov/newsreleases/biden-harris-administration-strengthens-safeguards-protect-families-and-children-lead>.

⁴⁹ <https://semspub.epa.gov/work/HQ/100003237.pdf>.



Superfund Lead Collaboration Pilot: In 2022, EPA completed the Superfund Lead Collaboration pilot, providing the Superfund program with lessons learned and best practices for collaborating at the federal, state, territorial, Tribal, and local levels to address multiple sources of lead in communities near Superfund sites where lead is a contaminant of concern. EPA will continue to incorporate best practices into the program, as appropriate.⁵⁰ In 2023, EPA shared best practices for Superfund lead collaboration in a training session at the National Brownfields Training Conference.

Soil Screening, Health, Outreach and Partnership (SoilSHOP): ATSDR continues to work to expand the use of SoilSHOP health education events to inform community members about the lead content of the soil in their immediate environments and best practices for safer gardening and prevention of childhood lead exposure.⁵¹ Since 2019, ATSDR has conducted more than 50 SoilSHOP events nationwide.

Soil Lead Action Levels: HUD included soil-lead hazard evaluation and control in the scoping of lead hazard reduction activities under its Lead Hazard Control grants and the Lead Safe Housing Rule. HUD requested modeling assistance from EPA, which led to a published paper that will inform HUD's updated soil lead action level for grantees.⁵²

⁵⁰ <https://www.epa.gov/superfund/superfund-accomplishments-report-fiscal-year-2022>.

⁵¹ <https://www.atsdr.cdc.gov/soilshop/index.html>.

⁵² <https://www.sciencedirect.com/science/article/pii/S0048969723057595?via%3Dihub>.

Objective 1.4. Reduce Exposure to Lead Associated with Emissions to Ambient Air



New Source Performance Standards (NSPS) and National Emissions Standard for Hazardous Air Pollutants (NESHAP): EPA proposed and published amendments to existing NSPS and NESHAP for hazardous air pollutants, including lead.

- In March 2024, EPA finalized amendments to the NESHAP for Integrated Iron and Steel Manufacturing Facilities.⁵³ This rule will reduce emissions of toxic metals, including lead, by nearly 64 tons per year.
- In January 2024, EPA proposed amendments to the NSPS for large municipal waste combustors to reduce emissions for all existing sources including particulate matter, ozone, and other hazardous air pollutants, including lead.⁵⁴
- In November 2023, EPA finalized amendments to the NSPS for Secondary Lead Smelters.⁵⁵ The new requirements include performance tests and emissions limits that will strengthen control of lead and other air toxics.

⁵³ <https://www.epa.gov/stationary-sources-air-pollution/integrated-iron-and-steel-manufacturing-national-emission>.

⁵⁴ <https://www.epa.gov/stationary-sources-air-pollution/large-municipal-waste-combustors-lmwc-new-source-performance>.

⁵⁵ <https://www.epa.gov/stationary-sources-air-pollution/secondary-lead-smelters-new-source-performance-standards-nsps>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- In July 2023, EPA published a supplemental proposal for the major source NESHAP for primary copper smelters.⁵⁶ The proposal further addressed hazardous air pollutant (HAP) metals and proposed new standards for previously unregulated HAPs. EPA extended the public comment period to September 22, 2023.
- In February 2023, EPA published amendments to the NSPS for Lead Acid Battery Manufacturing Plants and the NESHAP for Lead Acid Battery Manufacturing Area Sources.^{57, 58} These actions include revisions for lead emissions limits at specific stationary sources, requirements for performance testing, and establishment of work practices to minimize fugitive lead dust emissions.

Aviation Gasoline: EPA and the Federal Aviation Administration (FAA) have furthered activities to assess and address lead exposure from aviation gasoline.

- In October 2023, EPA released a final determination that emissions of lead from aircraft that operate on leaded fuel cause or contribute to air pollution that may reasonably be anticipated to endanger public health and welfare.⁵⁹ Under the Clean Air Act, EPA reviews information on air pollutants and sources of air pollution to determine whether they threaten human health or welfare. This is referred to as an “endangerment finding” — a first step in using EPA’s authority to address this source of lead pollution. EPA will propose and promulgate regulatory standards for lead emissions from aircraft engines based on this endangerment finding.
- FAA and partners in the aviation community launched the Eliminate Aviation Gasoline Lead Emissions (EAGLE) initiative, with the goal to eliminate leaded aviation fuels in piston-engine aircraft safely by the end of 2030.⁶⁰ In 2023, FAA issued its Fleet Authorization Policy Statement on unleaded aviation gasoline, and began its Airport Cooperative Research Program, to collect data and create best practices focused on the safe transition to unleaded fuels for the country’s fleet of 220,000 piston aircraft.

⁵⁶ <https://www.epa.gov/stationary-sources-air-pollution/primary-copper-smelting-area-sources-national-emissions-standards>.

⁵⁷ <https://www.epa.gov/stationary-sources-air-pollution/lead-acid-battery-manufacturing-new-source-performance-standards>.

⁵⁸ <https://www.epa.gov/stationary-sources-air-pollution/lead-acid-battery-manufacturing-area-sources-national-emission>.

⁵⁹ <https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-lead-emissions-aircraft>.

⁶⁰ <https://www.faa.gov/unleaded>.

Objective 1.5. Reduce Lead Exposure from Occupational Sources

Preventing Lead Exposure in Adults (PLEA) Workgroup: In 2023, CDC established the PLEA workgroup under the Lead Exposure and Prevention Advisory Committee (LEPAC).⁶¹ The purpose of the workgroup is to gather and review information on relevant literature and consult with experts to define and update the status of adult lead exposures, including occupational, in the U.S. for CDC/ATDSR to consider when setting priorities and undertaking initiatives related to lead.



Leave Lead at Work: In October 2023, the National Institute for Occupational Safety and Health (NIOSH) published a new fact sheet titled, “Leave Lead at Work” with recommendations for workers on what they can do before work, at work, and at home to prevent take-home lead.⁶²

Reducing Workers’ Lead Exposure During Water Service Line Removal and Replacement: In September 2023, NIOSH published a new resource to help employers and workers reduce hazards associated with lead pipe removal and replacement.⁶³ Recommendations for employers to reduce lead exposure include developing a written lead monitoring and control program which may include a testing protocol, hazard control methods, and job hazard assessments for tasks that may expose workers to lead. Recommendations for workers include improved work practices, such as cleaning surfaces, avoiding bringing personal items into contaminated areas, and using personal protective equipment to help reduce their lead exposure.

Advanced Notice of Proposed Rulemaking for Blood Lead Level for Medical Removal: In June 2022, DOL published an Advanced Notice of Proposed Rulemaking for Blood Lead Level for Medical Removal to seek input from the public on possible areas of the lead standards for revision to improve protection of workers in industries and occupations where preventable exposure to lead continues to occur.⁶⁴

Lead-safe Certified Contractors: In 2021 and 2022, EPA provided free training in lead-safe work practices—a group of techniques to prevent lead exposure resulting from renovation and repair activities—to 512 contractors, increasing the supply of trained contractors in 22 communities with environmental justice concerns. EPA’s RRP Rule requires that contractors performing RRP projects in pre-1978 homes, child care facilities, and preschools be lead-free certified.⁶⁵ These same 22 communities also participated in Lead Awareness Curriculum sessions.

⁶¹ <https://www.cdc.gov/nceh/lead/advisory/lepac.htm>.

⁶² <https://www.cdc.gov/niosh/docs/2024-101/default.html>.

⁶³ <https://www.cdc.gov/niosh/docs/wp-solutions/2023-141/default.html>.

⁶⁴ <https://www.federalregister.gov/documents/2022/06/28/2022-13696/advance-notice-of-proposed-rule-making-anprm-blood-lead-level-for-medical-removal>.

⁶⁵ <https://www.epa.gov/lead/local-training-and-outreach#RRPtraining>.

Worker Training Program: The National Institute of Environmental Health Sciences (NIEHS) Worker Training Program (WTP) continued its work with federal partners including EPA and HUD to reduce occupational exposures by incorporating information on lead hazards into training materials.⁶⁶ Since 2019, NIEHS grantees offered approximately 284 courses to 3,363 workers for a total of 40,085 training hours. The courses focus on protecting workers, homeowners, families and communities from exposure to lead hazards and meeting the training requirement by EPA’s Lead-Based Paint Abatement Program.

Objective 1.6. Reduce Exposure to Lead in Food

Closer to Zero: Reducing Childhood Exposure to Contaminants from Foods: In April 2021, the U.S. Food and Drug Administration (FDA) announced a new action plan to reduce exposure to toxic elements in foods commonly eaten by babies and young children to the lowest possible levels.^{67, 68}



- In January 2023, FDA announced draft guidance for industry on action levels for lead in processed foods that are intended for babies and children under two years of age, to help reduce potential health effects in this vulnerable population from dietary exposure to lead.⁶⁹ The proposed action levels would result in significant reductions in exposures to lead from food while ensuring availability of nutritious foods.
- In 2020, FDA published “U.S. Food and Drug Administration’s Interim Reference Levels for Dietary Lead Exposure in Children and Women of Childbearing Age,” and in 2022 updated the interim reference levels to 2.2 µg/day for children and 8.8 µg/day for women of childbearing age to serve as useful benchmarks in evaluating the potential for adverse effects of dietary lead.⁷⁰

⁶⁶ <https://www.niehs.nih.gov/careers/hazmat>.

⁶⁷ <https://www.fda.gov/food/environmental-contaminants-food/closer-zero-reducing-childhood-exposure-contaminants-foods>.

⁶⁸ *Closer to Zero* outlines a multi-phase, science-based, iterative approach to achieving the goal of getting levels of toxic elements in foods closer to zero over time.

⁶⁹ <https://www.fda.gov/news-events/press-announcements/fda-announces-action-levels-lead-categories-processed-baby-foods>.

⁷⁰ <https://www.sciencedirect.com/science/article/pii/S0273230019302806>.

Monitoring Foods and Juice for Lead: FDA routinely monitors domestic and imported foods and juices for lead through the Toxic Elements Program, Total Diet Study, and Laboratory Flexible Funding Model.^{71, 72, 73, 74} In 2022, FDA completed a survey of toxic elements, including lead, in baby foods.⁷⁵ These programs protect the public from chemical contaminants by monitoring products that are most likely to contribute to dietary intake of toxic elements, including lead.



Codex Alimentarius Commission: FDA participated in and led the Codex Alimentarius Commission (Codex), the body responsible for implementing the Food Standards Programme from the Food and Agriculture Organization of the United Nations and the World Health Organization, by working closely with the U.S. Codex Office at the U.S. Department of Agriculture.⁷⁶ The objective of FDA's participation in Codex is to develop science-based international food safety, labeling, and other pertinent standards that provide consumer protection, labeling information, and prevention of economic fraud and deception that are consistent with U.S. regulations and laws.

Objective 1.7. Reduce Exposure to Lead in Cosmetics and Personal Care Products

Lead Survey of Market Products: In October 2023, FDA completed a survey of 251 products to assess current lead levels in lipstick and externally applied cosmetic products on the U.S. market. Cosmetic products tested as part of this survey included blush, body powder, compact powder, eye shadow, face/body paint, foundation, lipstick, lotion, mascara and shaving/depilatory products. The survey data show that approximately 97% of the cosmetic products tested contain lead at levels below 10 ppm, which is the FDA recommended maximum level as outlined in the "Draft Guidance for Industry: Lead in Cosmetic Lip Products and Externally Applied Cosmetics: Recommended Maximum Level."⁷⁷ The survey results indicate that industry appears to be conforming with the 10 ppm lead level. FDA intends to develop a Final Guidance for Industry.

Public Announcements and Alerts: Between 2018 and 2023, FDA provided timely announcements and alerts to the public to protect from lead exposure.

⁷¹ <https://www.fda.gov/food/chemical-contaminants-pesticides/toxic-elements-foods-and-foodware>.

⁷² <https://www.fda.gov/media/157533/download>.

⁷³ <https://www.fda.gov/food/fda-total-diet-study-tds/fda-total-diet-study-tds-results>.

⁷⁴ <https://www.fda.gov/federal-state-local-tribal-and-territorial-officials/grants-and-cooperative-agreements/laboratory-flexible-funding-model-cooperative-agreement-program>.

⁷⁵ <https://www.tandfonline.com/doi/full/10.1080/19393210.2022.2146209>.

⁷⁶ <https://www.fda.gov/food/international-cooperation-food-safety/fdas-participation-codex>.

⁷⁷ <https://www.fda.gov/regulatory-information/search-fda-guidance-documents/draft-guidance-industry-lead-cosmetic-lip-products-and-externally-applied-cosmetics-recommended>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- In February 2022, FDA alerted consumers to the dangers of using traditional eye cosmetics containing Kohl, Kajal, Al-Kahal, Surma, Tiro, Tozali, or Kwalli because the ingredients often contain high levels of lead. Products containing these ingredients are subject to Import Alert 53-06 because they are adulterated and/or misbranded with non-permitted color additives.^{78, 79}
- As of January 2022, lead acetate is no longer allowed as a color additive in “progressive” hair dyes.⁸⁰ This is based on FDA’s October 2018 determination that the available data no longer support the safe use of lead acetate as a color additive in hair dyes.⁸¹

Objective 1.8. Reduce Exposure to Lead in Consumer Products

Enforcement of Lead-Safe Consumer Products: Between 2018 and 2023, the U.S. Consumer Product Safety Commission (CPSC) continued to enforce regulations regarding lead content and lead-based paint limits for consumer products⁸² and to enforce labeling requirements to prevent consumer product-related lead exposure.⁸³

- CPSC continued a focus on enforcement, including port surveillance efforts, where CPSC annually screens tens of thousands of products for lead and other hazards.

Heavy Metals in Cultural Products Webtool: In April 2023, EPA published the Heavy Metals in Cultural Products Webtool, which connects the public to educational and outreach resources to prevent lead and other heavy metal exposures in cultural products, including cosmetics, spices, religious powders, cookware and traditional medicines.⁸⁴ The educational resources and the search tool are available in multiple languages.

International Cooperation: Between 2018 and 2023, CPSC’s International Programs Office continued working with international partners to improve manufacturing and regulatory coordination and to encourage the use of best practices that will protect consumers from lead in products and paints, including children’s products. In 2020, CPSC released several episodes of their International Video and Podcast Series on lead requirements.⁸⁵



⁷⁸ <https://www.fda.gov/cosmetics/cosmetic-products/kohl-kajal-al-kahal-surma-tiro-tozali-or-kwalli-any-name-beware-lead-poisoning>.

⁷⁹ https://www.accessdata.fda.gov/CMS/IA/importalert_130.html.

⁸⁰ <https://www.fda.gov/food/cfsan-constituent-updates/fda-repeal-color-additive-approval-use-lead-acetate-hair-dyes#:~:text=Today%2C%20the%20FDA%20announced%20that%20we%20are%20removing,coloring%20hair%20n%20the%20scalp%20%2821%20CFR%2073.2396%29..>

⁸¹ <https://www.federalregister.gov/documents/2018/10/31/2018-23725/termination-of-listing-of-color-additive-exempt-from-certification-lead-acetate>.

⁸² <https://www.cpsc.gov/Business--Manufacturing/Business-Education/Lead/Lead-in-Paint>.

⁸³ <https://www.cpsc.gov/Business--Manufacturing/Business-Education/Business-Guidance/FHSA-Requirements>.

⁸⁴ <https://www.epa.gov/children/heavy-metals-cultural-products>.

⁸⁵ <https://www.cpsc.gov/Business--Manufacturing/International/International-Video-and-Podcast-Series>.

Objective 1.9. Reduce Lead Exposure Through Enforcement and Compliance Assistance

Interagency Collaboration: Multiple agencies have continued and expanded their partnerships on preventing children’s exposure to lead.

- In February 2024, EPA, CDC, and HUD announced interagency commitments for more robust collaboration on addressing risks of exposures to lead. First, EPA and HUD entered into an updated Memorandum of Understanding (MOU) to expand and reaffirm a 1997 agreement on the EPA and HUD’s collaborative enforcement efforts addressing lead-based paint hazards in housing. Second, EPA and HUD entered into a complementary MOU with CDC, to pilot data sharing among the agencies to share their knowledge about communities that likely are facing a higher risk of exposure to lead, to help the agencies prioritize their work to address those risk.⁸⁶
- In 2023, EPA continued outreach and collaboration efforts with the Department of Defense and civilian federal agencies, such as the Department of Veterans Affairs, to identify how to improve compliance with lead-related environmental regulations that address children’s health, including federal agencies’ work with companies that manage, operate, or maintain privatized housing on federal facilities.



Enforcement of Lead-Based Paint Laws and Regulations: Between 2018 and 2023, multiple agencies supported enforcement and compliance activities to protect communities from lead exposure. EPA’s lead-based paint enforcement program prioritizes its work in two primary areas: (1) companies, individuals, and homes with far-reaching, often multi-state or multi-regional operations or impacts; and (2) targeted compliance outreach and enforcement in specific communities heavily burdened by lead-based paint exposure, known as Geographic Initiatives. HUD and EPA continued to work together on enforcement of the Lead Disclosure Rule, which requires disclosure of known information on lead-based paint and lead-based paint hazards before the sale or lease of most pre-1978 housing. HUD enforced its Lead Safe Housing Rule on lead safety in assisted pre-1978 housing. DOJ continued to work with its agency partners to conduct judicial enforcement of the lead paint rules. Recent examples of lead paint enforcement actions that exemplify these strategies include:

⁸⁶ https://www.hud.gov/press/press_releases_media_advisories/HUD_No_24_037

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- Between 2019 and 2023, EPA’s lead-based paint enforcement program conducted over 4,000 compliance monitoring inspections (on- and off-site) to ensure compliance with lead-based paint laws and regulations. Where inspections found evidence of violations, EPA took enforcement action to return the entity to compliance, establish deterrence from future non-compliance and address risks created as a result of the alleged violations.⁸⁷ Some highlights include:
 - EPA completed over 500 lead-based paint enforcement cases, recovering over \$25 million in civil penalties.
 - Some penalty cases included Supplemental Environmental Projects or conditions of settlement, collectively resulting in over \$2.2 million of lead abatement projects in low-income housing, eliminating the risk of exposure to lead-based paint to families living in those homes. For example, a major Chicago-based firm was ordered to pay a \$400,000 penalty for violating lead-based paint renovation rules and required to institute a compliance system to protect customers by using lead-safe practices during home renovations and pay \$2 million for lead-based paint abatement work in lower-income properties in Chicago communities.⁸⁸
 - Multiple states authorized to implement the RRP Rule joined EPA in a \$20.75 million settlement with a major home improvement business for violations of the RRP Rule. Under the settlement, the firm has implemented a comprehensive corporate-wide program to ensure that contractor firms and renovators it hires are certified and trained to use lead-safe work practices.⁸⁹
 - EPA settlements have resulted in defendants informing the public and regulated community about lead-based paint requirements and risks to exposure to lead-based paint.
 - For example, EPA’s enforcement settlements with the renovation firms on national television shows, such as *Fixer to Fabulous* (2024), *Maine Cabin Masters* (2022), *Texas Flip N’ Move* (2021), and *Bargain Mansions* (2020), required the firms to educate millions of viewers about lead-based paint safety in nationally broadcasted television episodes, podcasts and social media posts.⁹⁰ A non-

⁸⁷ <https://www.epa.gov/enforcement/enforcing-lead-laws-and-regulations>.

⁸⁸ <https://www.epa.gov/newsreleases/epa-and-doj-announce-settlement-logan-square-aluminium-supply-over-lead-violations>.

⁸⁹ <https://www.epa.gov/enforcement/home-depot-settlement-information-sheet>.

⁹⁰ *Fixer to Fabulous*, available at:

[https://yosemite.epa.gov/oa/rhc/epaadmin.nsf/Advanced%20Search/52D60042A960234385258A9F005DE46F/\\$File/2024-6163.pdf](https://yosemite.epa.gov/oa/rhc/epaadmin.nsf/Advanced%20Search/52D60042A960234385258A9F005DE46F/$File/2024-6163.pdf); *Maine Cabin Masters*, available at: <https://www.epa.gov/newsreleases/epa-announces-settlement-maine-based-tv-show-resolve-lead-renovation-repair-and>, <https://www.youtube.com/watch?v=0Isx4Zi97BA>, and in episodes 1 and 2 of season 10; *Texas Flip N’ Move*, available at: <https://www.epa.gov/newsreleases/epa-settles-texas-flip-n-move-tv-show-alleged-lead-based-paint-violations>. *Bargain Mansions*, available at <https://www.epa.gov/newsreleases/epa-settlements-rehab-addict-and-bargain-mansions-tv-shows-alleged-violations-lead#:~:text=Further%2C%20the%20companies%20and%20their,appropriate%20renovation%20procedures%20in%20self%2D>, <https://www.facebook.com/watch/?v=732972034089783>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- television defendant agreed to promote lead-based paint education in thousands of stores and on their YouTube channel.⁹¹
- By August 2023, lead-based paint abatement projects were completed in Fort Worth, Texas communities resulting from EPA's 2021 settlement with HGTV's "Texas Flip N' Move".⁹²
 - Starting in 2018, EPA settled cases in Iowa, Kansas, Missouri, Nebraska, and nine Tribal nations with producers of three TV home renovation programs: Magnolia Waco Properties, LLC; Detroit Renovations; and Bargain Mansions. The conditions of each of the settlements included lead abatements and generating and running public service announcements warning the public of the dangers of lead and following EPA regulatory requirements for safe renovations.^{93, 94}
 - From January 2019 through September 2023, EPA and U.S. Department of Justice (DOJ) completed significant civil and criminal prosecutions focused on geographic areas that suffer from disproportionate levels of lead exposure, initiated investigations of property management companies managing privatized military housing, and took actions against renovators to address pre-1978 housing with lead-based paint.
 - In September 2023, DOJ and EPA entered into a Consent Decree with Apex Building Company for violating TSCA and EPA's RRP rule during renovation of apartment units in New York.⁹⁵
 - In February 2023, DOJ and EPA entered into Consent Decrees with the principal of CISNE NY Construction Inc. for violating provisions of TSCA and the RRP Rule that protect public health by reducing the risk of lead poisoning during renovations in residential buildings that may contain lead paint.⁹⁶
 - In January 2023, DOJ and EPA announced a settlement agreement that included \$2 million of lead-based paint abatement work in lower-income properties located in Chicago and Chicago suburbs in communities with a higher incidence of childhood lead poisoning.⁹⁷
 - In December 2022, with support from EPA and HUD, DOJ sentenced a Richmond contractor to 16 months in federal prison for violating federal laws regarding lead-based paint work practices.⁹⁸

⁹¹ https://youtu.be/odXPC5BRuEY?si=uTLumBpMYGdT_VYu; description of lead safety educational measures in stores and online, available at <https://www.epa.gov/sites/default/files/2021-04/documents/homedepotusainc.pdf>.

⁹² <https://www.epa.gov/newsreleases/epa-settles-texas-flip-n-move-tv-show-alleged-lead-based-paint-violations>.

⁹³ <https://19january2021snapshot.epa.gov/sites/static/files/2018-06/documents/magnoliawacopropertiesllcconsentagreementandfinalorder.pdf>.

⁹⁴ <https://www.epa.gov/newsreleases/epa-settlements-rehab-addict-and-bargain-mansions-tv-shows-alleged-violations-lead>.

⁹⁵ <https://www.justice.gov/usao-sdny/pr/united-states-obtains-consent-decree-against-apex-building-company-violating-lead>.

⁹⁶ <https://www.justice.gov/usao-sdny/pr/united-states-enters-consent-decrees-principals-cisne-ny-construction-inc-violating>.

⁹⁷ <https://www.epa.gov/newsreleases/epa-and-doj-announce-settlement-logan-square-aluminium-supply-over-lead-violations>.

⁹⁸ <https://www.justice.gov/usao-sdin/pr/richmond-contractor-sentenced-over-1-year-violating-federal-lead-paint-laws-and>.

- In January 2019, DOJ, HUD and EPA announced a new agreement for New York City Housing Authority to fundamentally reform operations and remedy living conditions for its residents, including lead paint hazards, mold growth, pest infestations, lack of heat, and inadequate elevator service after allegedly making false statements to HUD and the public regarding its lead paint compliance and intentionally deceiving HUD inspectors.⁹⁹
- In 2022, EPA published a notice describing its expectations for the lead-based paint compliance responsibilities of Property Management Companies. This action is especially important for underserved and overburdened communities, which often include a high proportion of rental housing, and the military community, where family housing is often managed by such companies.¹⁰⁰



Lead Cleanup at Superfund Sites and RCRA Corrective Action Facilities using Enforcement

Activities: Using Superfund authority, EPA has secured the cleanup of lead in tens of thousands of residential yards, immediately reducing the risk of lead exposure to those living, working, and playing in nearby homes. For example:

- Between 2018 and 2022, EPA entered into enforceable agreements addressing lead and lead-related issues at, among others, the Big River site in Missouri (\$80 million settlement), the USS Lead site in Indiana (\$32 million settlement), the Delfab site in Michigan (\$1.2 million settlement), the Lower Darby Creek site in Pennsylvania (\$8.4 million settlement), the Sherwin-Williams/Hilliard's Creek site in New Jersey (\$148.5 million in settlements), and a judicial settlement addressing sites in seven EPA regions (\$75.7 million).

⁹⁹ <https://www.justice.gov/usao-sdny/pr/manhattan-us-attorney-announces-new-agreement-fundamental-reform-nycha>.

¹⁰⁰ <https://www.epa.gov/newsreleases/epa-affirms-building-managers-responsible-lead-based-paint-safety-requirements-when>.

Enforcement of Lead in Drinking Water: EPA works with states and federal agencies to enforce rules to protect communities from lead exposure in drinking water.

- In November 2023, EPA announced proposed improvements to the Lead and Copper Rule to protect communities from lead in drinking water. To ensure premise plumbing does not reintroduce lead into treated drinking water that systems provide to homes and businesses, EPA began compliance monitoring



and enforcement efforts to ensure plumbing products with a potable application are “lead free” in accordance with the Safe Drinking Water Act (SDWA).¹⁰¹ EPA increased Lead and Copper Rule focused inspections of regulated public water systems to protect communities from lead in drinking water; specifically, EPA has created a protocol for conducting public water system inspections focused on the Lead and Copper Rule.

- EPA is working with states and other federal agencies, including FDA and Customs and Border Protection, to enforce SDWA and the Lead-Free Rule which requires pipes, plumbing fittings, and fixtures providing water for human consumption to meet EPA’s lead-free definition. The cross-agency collaboration maximizes resources to ensure manufacturers or importers have certified their plumbing products meet the Lead-Free rule requirements, thereby reducing the public’s overall exposure to lead.

Enforcement Resources: EPA directed enforcement resources to communities with environmental justice concerns to help address exposures to lead.

- In June 2023, EPA published the Environmental Justice Toolkit for Lead-Based Paint Enforcement Programs, which includes strategies for developing partnerships, conducting community engagement, and maintaining ongoing communication with the communities where enforcement activities are planned or ongoing.¹⁰² The Toolkit also provides methods for how to target inspections in overburdened communities, and information and examples on remedies that enhance environmental justice.¹⁰³
- In 2023, EPA engaged in multiple community-based enforcement initiatives. Some highlights include:

¹⁰¹ Premise plumbing is defined as the portion of a water system, including both hot and cold water, various devices (such as a hot water heater, HVAC humidifier), fixtures (such as showers, faucets), and drains (such as sinks, toilets) connected to the main distribution system via service lines. Learn more: <https://www.epa.gov/emergency-response-research/premise-plumbing-decontamination>.

¹⁰² <https://www.epa.gov/system/files/documents/2023-07/ejleadpainttoolkit.pdf>.

¹⁰³ <https://www.epa.gov/system/files/documents/2023-07/ejleadpainttoolkit.pdf>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- EPA concluded three cases in New England (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont) related to geographic initiatives in communities with environmental justice concerns, recovering over \$130,000 in penalties. Additionally, in Hartford, New Haven, and Fairfield Counties, Connecticut, EPA provided compliance assistance to contractors and landlords, as well as to child-occupied facilities and property management companies.
- EPA is developing, initiating and resolving enforcement cases that continue to result from 32 compliance monitoring inspections and activities conducted during geographic initiatives in Lorain County, Ohio (in Fiscal Year 2019); South Bend, Indiana (in Fiscal Year 2022); and Peoria, Illinois (in Fiscal Year 2023). EPA also conducted compliance assistance and lead awareness outreach in Peoria, Illinois.
- Over the last few years, EPA has engaged in several geographical initiatives in Missouri:
 - Distributed “Renovate Right” and “Protect Your Family from Lead” booklets to the Restore SGF Program in Springfield and two RRP courses in Fiscal Year 2023 in the St. Louis area.¹⁰⁴ Also in 2023, digital ads promoting the RRP Program and safe renovation practices ran in the St. Louis area, reaching over an estimated 1 million people; and
 - Conducted 76 inspections in the Springfield area in Fiscal Year 2022 and 67 inspections in the St. Louis and the Southeastern areas of Missouri in Fiscal Year 2023, focusing primarily on businesses and worksites located in areas with potential environmental justice concerns.
- EPA focused outreach and compliance efforts in several communities with potential environmental justice concerns including Anchorage and Juneau, Alaska; Yakima, Everett and Tacoma, Washington; and Portland, Salem, and Milwaukee, Oregon. Over 70% of the 237 lead paint inspections this year took place in communities with potential environmental justice concerns.



¹⁰⁴ <https://www.epa.gov/lead/lead-safety-documents-and-outreach-materials>.



Goal 2:

Identify Lead-Exposed Children and Improve Their Health Outcomes

Key Priorities: Improve identification of children exposed to lead through surveillance of Blood Lead Level data and foster access to services and support designed to improve children’s physical, developmental and mental health. Ideally, these services would be provided through a patient-centered medical home in a coordinated system of care.

Impact: Expanding the federal government’s efforts to identify children in high-risk communities will target resources for interventions and services and improve health outcomes.

Objective 2.1. Improve Surveillance of Blood Lead Levels (BLLs) to Identify Children Exposed to Lead

Identifying High Lead Exposure Risk

Locations: From 2022 to 2024, EPA led four collaborative peer-reviewed journal publications identifying high lead exposure risk locations with maps and analyses. This included a Michigan lead data mapping analysis now used by state agency partners and an Ohio lead data mapping analysis which applies the same methodology; an interagency state-of-the-science paper that summarized federal progress and the remaining challenges for implementing Goal 2 and an initial step-by-step blueprint; and an interagency U.S. lead exposure mapping analysis which identified states and counties with higher potential lead exposure risks based on housing age and sociodemographic data at census tract scale.^{105, 106, 107, 108}



- In 2023, EPA developed an interim analytical blueprint for identifying high lead exposure risk locations based on research in Michigan, which it is currently testing and continuing to improve through collaborations with state and Federal partners in Michigan and West Virginia. EPA presented the findings to state and local governments through the EPA Tools and Resources Webinar Series with over 700 attendees in February 2023, and the National Environmental Health Association Conference in August 2023.¹⁰⁹ A systematic blueprint approach with state-specific examples of science in action, using the published methods, is being developed and applied to inform whole-of-government efforts addressing disproportionate impacts and to aid in capacity building.

Lead Detect Prize: In November 2023, CDC announced a Lead Detect Prize on challenge.gov with a \$1 million prize pool to accelerate the development of next-generation point-of-care blood lead testing technology.¹¹⁰ The National Aeronautics and Space Administration (NASA) and FDA support the challenge, and it spotlights the urgent need to identify and foster new or existing breakthrough solutions and products for optimal lead testing in children. The first phase of the multiphase challenge calls upon researchers and innovators across disciplines to submit concepts and Lead Detect Prize development plans for advanced point-of-care blood lead tests that could detect very low blood lead levels with reduced risk of blood sample contamination from the environment. Each Phase 1 winner will receive an equal share of the \$150,000 Phase 1 prize pool and an exclusive invitation to participate and compete for \$850,000 in total prizes during Phase 2.

¹⁰⁵ <https://ehp.niehs.nih.gov/doi/10.1289/EHP9705>.

¹⁰⁶ <https://www.nature.com/articles/s41370-024-00666-x>.

¹⁰⁷ <https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2022.307051>.

¹⁰⁸ <https://pubs.acs.org/doi/10.1021/acs.est.3c07881>.

¹⁰⁹ <https://www.epa.gov/research-states/epa-tools-and-resources-webinar-series>.

¹¹⁰ <https://www.challenge.gov/?challenge=lead-detect-prize>.

Commitment to Health Equity Initiative: As part of CDC’s CORE Commitment to Health Equity initiative, CDC evaluated efforts to improve testing rates in children ages 1 to 2 years who are enrolled in Medicaid and established baseline measures for Medicaid screening by state and nationally.¹¹¹ The CORE strategy involves collaborating with multi-sectoral partners to incorporate health equity as a foundational component. To identify promising practices in this area, CDC formed the CORE Community of Practice (CoP) in August 2023 with nine Childhood Lead Poisoning Prevention Program (CLPPP) recipients. The CORE CoP meets quarterly to discuss lessons learned from implementing blood lead testing strategies for children enrolled in Medicaid. Promising practices from this initiative will be disseminated to all 62 CLPPP recipients at the end of the project period.

Blood Lead Reference Value: In October 2021, CDC updated the blood lead reference value (BLRV) from 5.0 µg/dL to 3.5 µg/dL.¹¹² A BLRV is intended to identify children with higher levels of lead in their blood compared with levels in most children. The value is based on the 97.5th percentile of the blood lead distribution in U.S. children ages 1 to 5 years and is updated periodically to reflect progress in decreasing exposures. Updating the reference value encourages CDC, federal agencies, health departments, providers, communities, and other partners to focus resources on children with the highest levels of lead in their blood, identify and eliminate sources of lead exposure, and take prompt actions to reduce the harmful effects of lead. Federal agencies are aligning with the updated reference value; for example, FDA updated the interim reference levels for dietary lead as part of its *Closer to Zero* plan.¹¹³ Jurisdictions should continue to follow the Centers for Medicare & Medicaid Services requirement that all Medicaid-enrolled children be tested at ages 12 months and 24 months or at age 24-72 months if they have not previously been screened.



¹¹¹ <https://www.cdc.gov/healthequity/core/index.html>.

¹¹² <https://www.cdc.gov/nceh/lead/news/cdc-updates-blood-lead-reference-value.html>.

¹¹³ <https://www.sciencedirect.com/science/article/pii/S0273230022000897?via%3Dihub>.

Objective 2.2. Facilitate Follow-up Blood Lead Testing and Monitoring of Children Identified as Lead-Exposed

All Ages Lead Model: In April 2024, EPA announced the availability of the All-Ages Lead Model (AALM), Version 3.0.¹¹⁴ The AALM evaluates the impact of lead exposures on lead levels in humans. It rapidly estimates the effect of exposures on lead concentrations in tissues of children and adults; can assess exposures of a day or more, as well as chronic exposures; and can be applied to specific individuals or to groups of similarly exposed individuals.

Childhood Lead Poisoning Prevention and Surveillance: In 2021, CDC funded 62 state and local recipients under the “Childhood Lead Poisoning Prevention and Surveillance of Blood Lead Levels in Children” Cooperative Agreement to support childhood lead poisoning prevention activities. This included strengthening blood lead testing and reporting, surveillance, linking children to recommended follow-up services, and targeted population-based interventions.¹¹⁵ Cooperative Agreement recipients are expected to work closely with other agencies, partners, and stakeholders serving children to identify and ensure that a comprehensive system of referral, follow-up and evaluation is in place for children who are exposed to lead. Additionally, CDC is supporting capacity building in the Asian American and Pacific Islander (AAPI) population for childhood lead poisoning prevention programs.

Local Government Engagement: HUD continued to explore creative ways to work with states, Tribes, territories, and local communities to match children identified as lead-exposed with local environmental assessment services and enhanced health services.

Pediatric Environmental Health Specialty Units: ATSDR and EPA supported the efforts of the Pediatric Environmental Health Specialty Units (PEHSUs) through continued funding and programmatic support to increase the number of obstetricians, pediatricians, and nurses with continuing education on prevention, diagnosis, management and treatment of lead exposure and other environmental exposures.¹¹⁶ PEHSUs are involved in a variety of activities that facilitate lead testing and monitoring:

- Training community health workers and other health professionals on how to recognize and respond to lead exposures;
- Providing grand rounds presentations to health professionals and presentations to communities on lead screening;
- Providing presentations at medical practices to increase lead screening; and
- Responding to consultation requests on lead and helping to coordinate care for lead exposed children.

In 2023, nearly 30,000 healthcare professionals received training under the PEHSU program. In addition, lead has historically been and continues to be among the top environmental exposure concerns on which PEHSUs are consulted and is among the top environmental concern on which PEHSUs provide education and outreach materials through collaborations with communities and local and state public health authorities. For example, in FY2018 and FY2019, PEHSU education and outreach efforts reached between approximately 34,000 and 36,000 community members and healthcare professionals each year with lead exposure as the most frequent environmental health hazard covered.

¹¹⁴ <https://www.epa.gov/land-research/all-ages-lead-model-aalm>.

¹¹⁵ <https://www.cdc.gov/nceh/lead/programs/2021-funded-recipients.html>.

¹¹⁶ <https://www.pehsu.net/>.

Objective 2.3. Facilitate Screening for Developmental Delays in Children Identified as Lead-Exposed

“Learn the Signs. Act Early” Campaign:

CDC continued to encourage primary care and other providers to promote child development monitoring through CDC’s “Learn the Signs. Act Early” campaign, which offers research-based, parent-friendly public tools to track milestones from age 2 months through 5 years.¹¹⁷ USDA makes this resource available through its Women, Infants, and Children (WIC) Works Resource System, which helps to



promote parent awareness and, if needed, to talk to a healthcare provider and/or early intervention specialist.¹¹⁸ In addition, the Health Resources and Services Administration supports “Mother-To-Baby,” which is an initiative that provides resources for people who are pregnant and/or breastfeeding, including those focused on exposure to lead and the risks during pregnancy and breastfeeding.¹¹⁹

Objective 2.4. Facilitate Referrals and Receipt of Appropriate Services for Children Identified as At-Risk for Developmental Delays Due to Lead Exposure

Resources for PEHSUs: Between 2018 and 2023, CDC/ATSDR and EPA provided PEHSUs and public health agencies with information and resources on identifying and treating lead poisoning and reducing lead exposure and improving health outcomes.^{120, 121}

In addition, yearly funding provided by CDC/ATSDR and EPA allows for PEHSUs to educate communities; coordinate response efforts; provide technical assistance; and provide individual consultation and care coordination on a myriad of environmental health concerns including lead exposure. For example, PEHSUs may use this funding to coordinate environmental home assessments to ensure that families are living in safe environments when a hazard such as lead is of concern. If homes are found to be hazardous, PEHSUs interface with landlords, property managers, housing authorities, and contractors to address hazards. This funding also allows PEHSU healthcare professionals to consult and coordinate care with pediatricians, primary care physicians, public health officials and others on children’s health concerns such as the source of elevated blood lead level including those which may be less common such as cultural products, spices, cosmetics or other consumer products. As an example, for a child’s lead exposure from jewelry, PEHSU staff worked with the family, their primary care physician, Boston Children’s Hospital, the U.S. Geological Survey, and Massachusetts Department of Public Health to treat an elevated blood lead level of 97 µg/dL, significantly higher than the CDC’s blood lead reference value of 3.5 µg/dL.¹²²

¹¹⁷ <https://www.cdc.gov/ncbddd/actearly/index.html>.

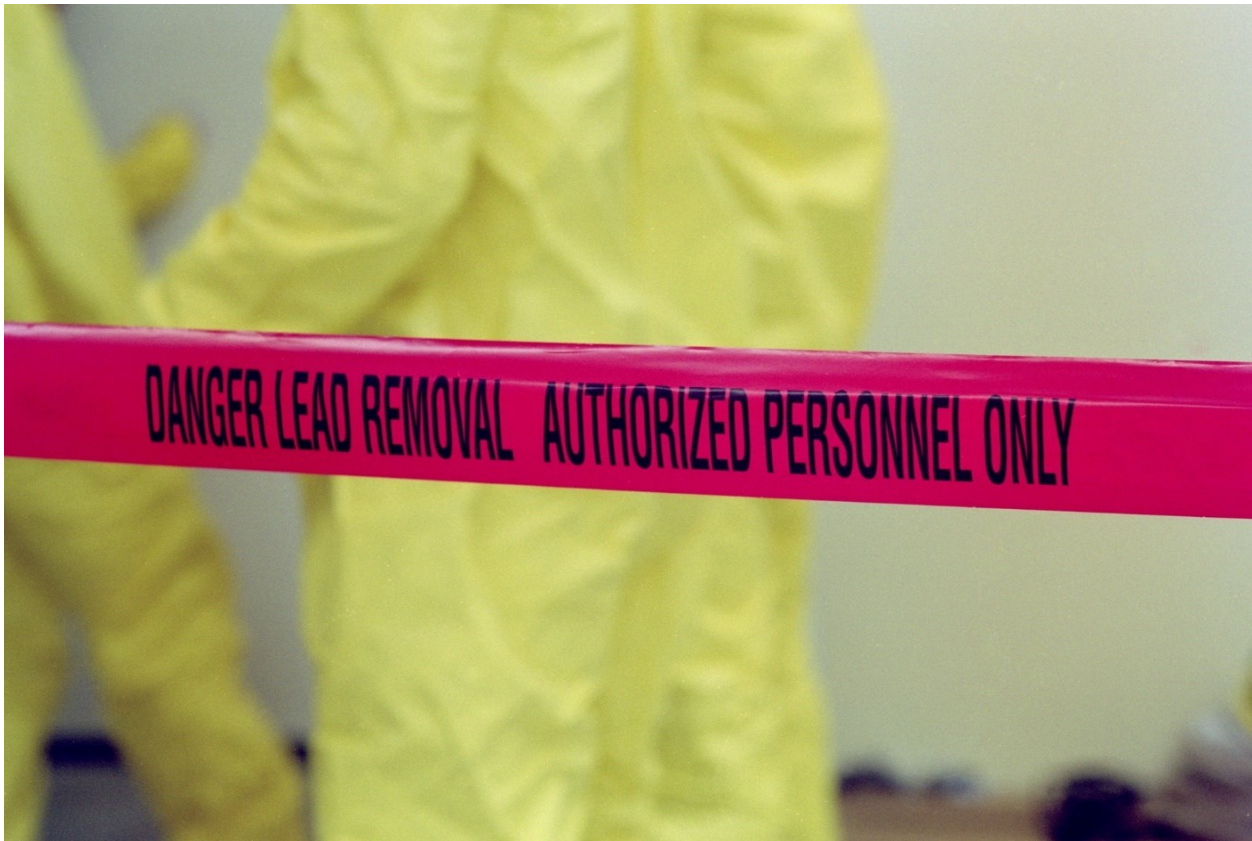
¹¹⁸ <https://wicworks.fns.usda.gov/resources/learn-signs-act-early>

¹¹⁹ <https://mothertobaby.org/pregnancy-breastfeeding-exposures/lead/>.

¹²⁰ https://www.pehsu.net/Lead_Exposure.html.

¹²¹ <https://www.cdc.gov/nceh/lead/audience/healthcare-providers.html>.

¹²² <https://www.sciencedirect.com/science/article/abs/pii/S1876285924001086>.



Goal 3:

Communicate More Effectively with Stakeholders

Key Priorities: Improve public awareness of the dangers associated with lead exposure by consolidating and streamlining federal messaging on reducing exposures to lead.

Impact: Communicating early and often with all stakeholders will assist state, Tribal and local governments in their on-the-ground community-based efforts to reduce lead exposures in their communities and provide information for community members, including parents.

Objective 3.1. Consolidate and Streamline Federal Lead-Related Communication and Messaging

The President’s Task Force on Environmental Health Risks and Safety Risks to Children Lead Subcommittee Webpage: An online portal is available and regularly updated to enhance, consolidate and streamline federal-wide communication to the public, providing a central webpage to share current federal activities, accomplishments, and resources.¹²³

Children’s Health Protection Advisory Committee Recommendations: In September 2023, EPA charged the Children’s Health Protection Advisory Committee to provide recommendations to the Administrator on lead and community engagement. The charge focuses on the following: 1) increasing awareness about lead through effective outreach and education; 2) ensuring EPA uses its various authorities to address multiple sources of lead holistically; and 3) interacting with community members through meaningful and long-term engagements when conducting participatory science research to reduce lead exposure.¹²⁴

Interagency and Public Meetings: Multiple agencies hosted interagency and public meetings to communicate and promote lead prevention strategies and programs.

- In December 2023, CDC sponsored their Annual Recipients Meeting, “Strengthening Lead Poisoning Prevention after the COVID-19 Emergency,” in Atlanta. This was the first annual in-person meeting post COVID-19. There were over 200 in-person and about 60 virtual participants from Childhood Lead Poisoning Prevention Programs (CLPPPs), Michigan State University (Flint Registry), eleven local community-based organizations, representatives from the U.S. Pacific Islands, Arkansas, North Dakota, and Maryland, and various federal partners.
- In October 2023, CDC hosted the Lead Exposure and Prevention Advisory Committee (LEPAC) meeting in Atlanta. This was the first ever in-person meeting of the committee.¹²⁵



¹²³ <https://ptfcehs.niehs.nih.gov/activities/lead-exposures>.

¹²⁴ <https://www.epa.gov/children/childrens-health-protection-advisory-committee-chpac-comment-letters-and-meeting-materials>.

¹²⁵ <https://www.cdc.gov/nceh/lead/advisory/lepac-meeting-oct-16-17-2023.html>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- In 2018, EPA established a Federal Lead Task Force that covers Iowa, Kansas, Missouri, Nebraska and nine Tribal nations, to form a federal partnership to address the unique challenges of lead exposure and its effect on children in the region. The Task Force allows member agencies to combine the authorities and resources under their distinct missions to provide a holistic, community-solution approach. As of September 2023, the Task Force included 35 participants from ATSDR, CDC, EPA, HHS, HUD, the Office of the Assistant Secretary for Health (OASH), the Occupational Safety and Health Administration (OSHA), and USDA.

Educational Materials: Several agencies developed helpful educational materials for use in communities facing lead exposures.



- **Local Lead Action Plan Guide:** In 2023, EPA released the *Local Lead Action Plan Guide* (LLAP), a free, web-based educational framework designed to help local government officials identify lead issues and create a plan to address them.^{126, 127}
- **Healthcare Video Series:** In November 2023, CDC published a series of videos to educate healthcare providers and public health professionals about the importance of lead poisoning as a public health problem and the need to increase lead testing and linkage to care services for young children.¹²⁸ The training will fill gaps in knowledge regarding the hazards of lead and provide lead program implementation suggestions for state and local partners and other public health professionals based on best practices. Continuing education credits are available for a wide range of medical and public health professionals.

¹²⁶ <https://www.epa.gov/newsreleases/epa-mid-atlantic-releases-local-lead-action-plan-llap-guide>.

¹²⁷ The LLAP Guide also allows local government officials to customize their plan to match their own unique priorities and address lead problems wherever they exist. In addition, under EPA's lead strategy, the Agency is working to identify communities with high lead exposures, and the LLAP Guide will be available as a resource for communities to improve their lead-related health outcomes.

¹²⁸ <https://www.cdc.gov/nceh/lead/resources/lead-poisoning-prevention-training.htm>.

- **Protect Your Family Pamphlet:** In 2021, co-authors EPA, HUD, and CPSC made updates to the *Protect Your Family* pamphlet to reflect reduced DLHS and DLCL.¹²⁹ The pamphlet explains the dangers of lead in the home and how to protect families from lead-based paint hazards. To ensure this critical information is meaningfully accessible to persons with limited English proficiency, the brochure is available in 12 languages: English, Arabic, Chinese Simplified and Traditional, French, Korean, Polish, Russian, Somali, Spanish, Tagalog and Vietnamese. This pamphlet is required by law to be provided in pre-1978 house purchases and rentals to consumers.
- **Lead Awareness in Indian Country: Keeping our Children Healthy! Curriculum:** In October 2020, EPA, in collaboration with over 200 Tribal partners, published the *Lead Awareness in Indian Country: Keeping our Children Healthy! Curriculum*.¹³⁰ It is a robust set of educational tools that provide practical, on-the-ground, community-based resources to reduce childhood lead exposure in communities. In November 2022, EPA published the Spanish version, *Concientización sobre el plomo en los terrenos indígenas: ¡Mantener sanos a nuestros niños!* In September 2023, EPA worked with partners to develop the *Lead Awareness Kids Activity Book* using excerpts from the Curriculum.¹³¹

Objective 3.2. Improve Awareness of Lead Hazards, Prevention and Remediation Among Diverse Populations, Especially Those Most at Risk

Public Educational Meetings and Outreach: Between 2018 and 2023, agencies continued to increase outreach events and engagements in collaboration with communities and lead-safe coalitions.

- Each October, CDC, EPA and HUD lead the National Lead Poisoning Prevention Week to bring together individuals, organizations, industry, and states, Tribes, territories, and local governments to increase lead poisoning prevention awareness in an effort to reduce childhood exposure to lead.^{132, 133, 134} In 2023, CDC, EPA and HUD developed an interagency toolkit, “Together, we can prevent lead exposure!” which focuses on providing lead-exposure information, and home and child testing resources and information.¹³⁵
- HUD conducts National Healthy Homes Month each year (previously in June; starting in 2024, in April), highlighting the key roles played by HUD grantees and their contributions to their communities everywhere and promoting Healthy Homes webinars and toolkits.¹³⁶
- In September 2023, EPA co-hosted the fifth Lead Summit for the area covering Iowa, Nebraska, Kansas, Missouri, and nine Tribal nations, in coordination with ATSDR, CDC, HUD, OASH, and various state and local partners. Over 250 attendees participated in person and virtually, most from state and local health departments, and included federal partners, academia and hospitals. The highlight of the Summit was the three interactive panels that provided insights on how they can together better reduce lead exposures and expanded their network of lead contacts.

¹²⁹ <https://www.epa.gov/lead/protect-your-family-lead-your-home-english>.

¹³⁰ <https://www.epa.gov/lead/tribal-lead-curriculum>.

¹³¹ <https://www.epa.gov/system/files/documents/2023-10/lead-awareness-kids-activity-book-508.pdf>.

¹³² <https://www.cdc.gov/nceh/lead/national-lead-poisoning-prevention-week.htm>.

¹³³ <https://www.epa.gov/lead/national-lead-poisoning-prevention-week>.

¹³⁴ https://www.hud.gov/program_offices/healthy_homes/NLPPW.

¹³⁵ <https://www.epa.gov/system/files/documents/2023-09/2023-NLPPWInfoKit-Eng.pdf>.

¹³⁶ https://www.hud.gov/program_offices/healthy_homes/nhnm.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

- In June 2023, EPA launched Community Lead Awareness, a series of free educational sessions on the dangers of lead and ways to reduce and prevent lead exposure. EPA hosted 96 educational sessions in 63 communities with known lead exposure issues.¹³⁷ EPA worked with community partners to plan and facilitate two sessions:
 - “Understanding Lead” sessions for community members to learn about lead, its impacts, actions to reduce and prevent lead exposure, and the importance of testing children’s blood lead levels. Parents, grandparents, community leaders, Tribal leaders, childcare workers, healthcare providers, youth (ages 12 years and up) and anyone else interested in learning more about lead were invited to attend; and
 - “Train-the-Trainer” sessions to equip community leaders — with or without prior knowledge about lead — to educate their communities about lead and preventing lead exposure using the Lead Awareness Curriculum.
- In April 2023, CDC released two information resource videos for the public and for high school students.¹³⁸ These brief videos provide an overview of the hazards of lead, where it can be found, and what can be done to reduce or prevent exposure. Closed captioning and auto-translation is available for each video.
- In January 2023, EPA, HUD, CDC and DOL participated in a White House summit on lead pipes with stakeholders and elected officials from across the country.¹³⁹ Vice President Kamala Harris, EPA Administrator Michael Regan, and numerous partners came together to announce the Biden-Harris Get the Lead Out Initiative and share resources and achievements with those active in the lead community.¹⁴⁰
- In 2021 and 2022, EPA implemented a local lead training and outreach initiative in 22 communities across the U.S. and Puerto Rico. EPA helped 512 contractors obtain lead-safe certification and educated 871 participants nationwide about lead and how to protect themselves, their loved ones, and their communities from lead exposure.
- In December 2021, the White House announced the Biden-Harris Lead Pipe and Paint Action Plan, which laid out over 15 new commitments from more than 10 federal agencies to make sure that the federal government marshals every resource it can to make rapid progress towards ensuring a lead-free future.¹⁴¹

Grants and Funding Activities: HUD supports communities in their lead intervention programs through grants and funding related activities, such as technical assistance.

- In 2019 and 2020, HUD awarded a total of \$15 million to Tribes through 18 Healthy Homes Production for Tribal Housing grants dedicated to Tribal Community Health Centers to provide resources for lead and healthy home assessment and intervention.^{142, 143} In 2021, HUD evaluated

¹³⁷ <https://www.epa.gov/lead/community-lead-awareness-sessions>.

¹³⁸ <https://www.cdc.gov/nceh/lead/resources/lead-poisoning-prevention-training.htm>.

¹³⁹ <https://www.whitehouse.gov/briefing-room/statements-releases/2023/01/27/fact-sheet-biden-harris-administration-announces-new-actions-and-progress-to-protect-communities-from-lead-pipes-and-paint/>.

¹⁴⁰ <https://www.epa.gov/water-infrastructure/get-lead-out-initiative>.

¹⁴¹ <https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/16/fact-sheet-the-biden-harris-lead-pipe-and-paint-action-plan/>.

¹⁴² <https://archives.hud.gov/news/2019/pr19-145.cfm>.

¹⁴³ <https://archives.hud.gov/news/2020/pr20-165.cfm>.

the program with state, Tribal, and local partners to identify best practices and gaps in services to inform the development of new funding opportunities.

- HUD continued to enhance partnerships with state, Tribal, and local governments, and key stakeholders that represent or serve communities at risk for childhood lead exposure. For example, in 2019, HUD contributed to activities generated through grantee programs and Community Build projects in Houston, Texas; Minneapolis, Minnesota; Worcester, Massachusetts; and Baltimore, Maryland. HUD also conducted yearly outreach about Lead Hazard Control Notice of Funding Availability opportunities.

International Activities: Multiple agencies work to reduce community exposure to lead in countries around the world.

- In January 2024, U.S. Agency for International Development (USAID) Administrator Samantha Power attended the World Economic Forum's Annual Meeting. There, the Administrator continued USAID's focus on expanding partnerships with the private sector to address critical global challenges and issued a global call to action to eliminate toxic lead from consumer products. To address the detrimental effects of lead poisoning in low and middle-income countries, USAID is aligning with other U.S. government efforts to improve child development, health, and education outcomes in India, South Africa and Bangladesh.¹⁴⁴ Through its missions around the world, USAID is raising awareness on the impact of lead exposure on health and development, as well as engaging with government officials on sources, policies, and regulations to prevent further exposures and support children who are exposed.
- In October 2023, the U.S. Department of State launched a \$1.3 million project with the International Centre for Diarrheal Disease Research (ICDDR) in Bangladesh to reduce lead exposure from contaminated aluminum cookware, a significant source of lead exposure in the country. ICDDR will work alongside government regulatory agencies and local community-based organizations to increase capacity for monitoring of lead in cookware, to support the development of national policies and regulations to mitigate incorporation of lead into cookware, and to increase public awareness of the human health risks and sources of lead exposure. The State Department, EPA and USAID are coordinating closely on planned and ongoing work, including supporting USAID work with its Missions and US Government teams in host countries to build out action plans to address host country gaps and opportunities in lead mitigation.
- Building on the success of its engagement in leaded fuel phase out globally, EPA has been working through an international partnership to eliminate lead paint in developing countries. EPA is now working through the United Nations and G7 to identify potential additional actions on reducing lead pollution and exposure in these countries.¹⁴⁵ To identify existing federal efforts and coordinate U.S. engagement, in 2023 EPA stood up and chairs a new international lead exposure working group under the Lead Subcommittee of the President's Task Force on Environmental Health Risks and Safety Risks to Children. In March 2024, EPA and USAID Administrators signed a Memorandum of Understanding formalizing joint commitment to cooperate in tackling a number of challenges including lead capacity building in low- and middle-income countries.

¹⁴⁴ <https://www.usaid.gov/leadfreefuture>.

¹⁴⁵ <https://www.epa.gov/international-cooperation/epa-cooperation-and-capacity-building-lead-pollution>.



Goal 4:

Support and Conduct Critical Research to Inform Efforts to Reduce Lead Exposures and Related Health Risks

Key Priorities: Prioritize and address the critical research and data needs to inform lead policies and guide decisions.

Impact: Advance scientific understanding of multimedia lead exposures and their relationship to BLLs, and improve/provide data, tools, methods, and technologies for targeting effective prevention and mitigation solutions.

Objective 4.1. Conduct and Collaborate on Research to Support Federal Lead Action Plan Goals

Research Collaborations: Between 2018 and 2023, several agencies collaborated on research that furthers Federal Lead Action Plan goals.

- EPA, HUD, CDC and ATSDR collaborated on two published papers advancing research for identifying lead exposure hotspot locations in the U.S.: an overview of the state-of-the-science on lead hotspots mapping, federal collaborations, and remaining challenges; and a U.S. lead exposure hotspots analysis.^{146,147} CDC, HUD and EPA collaborated on a study describing methods and utility of small area prevalence studies to identify localities with high lead exposure risk.¹⁴⁸
- EPA and HUD collaborated on exposure-BLL modeling research supporting Goal 1 efforts, including a publication focused on soil and dust lead contamination.¹⁴⁹

Critical Research to Support Intervention: EPA continued to support and conduct critical research to inform lead exposure and related health risk interventions. Please see [Appendix 2](#) for more information. Examples include:

- EPA provided yearly updates to lead service line identification technology resources. In 2023, EPA provided updates through presentations at the EPA Small Systems Challenges and Solutions Workshop.¹⁵⁰ The annual workshop brings together professionals from states and territories, Tribes, federal agencies, academia, NGOs, local agencies, and others to share the latest information on challenges facing small drinking water systems and solutions to address them.
- In January 2024, EPA released the Integrated Science Assessment (ISA) for lead.¹⁵¹ This ISA synthesizes the most policy-relevant science examining the relationships between lead exposures and human health or ecosystem effects. The lead ISA provides the scientific basis for EPA's decisions regarding whether the current National Ambient Air Quality Standards (NAAQS) for lead sufficiently protect public health and the environment and whether to retain or revise these standards. The draft ISA was reviewed by EPA's Clean Air Scientific Advisory Committee (CASAC) Lead NAAQS Review Panel at a public meeting in June 2023. The CASAC's advice on the draft ISA was conveyed to EPA in late September 2023. In May 2023, EPA additionally released Volume 3 of the Integrated Review Plan (IRP) for lead, the planning document for conducting quantitative exposure and risk analyses in support of the NAAQS review (Volumes 1 and 2 of the IRP were released in 2022). Volume 3 was discussed at a consultation with the CASAC Lead NAAQS Review Panel at a public meeting in June 2023.
- In December 2019, EPA led a series of interagency meetings to organize a federal lead research effort focused on planning implementation of Goal 4 of the Federal Lead Action Plan. Participants shared information summarizing state-of-the-science and current efforts; highlighted and

¹⁴⁶ <https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2022.307051>.

¹⁴⁷ <https://pubs.acs.org/doi/10.1021/acs.est.3c07881>.

¹⁴⁸ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9141915/>.

¹⁴⁹ <https://www.sciencedirect.com/science/article/pii/S0048969723057595?via%3Dihub>.

¹⁵⁰ <https://www.epa.gov/water-research/20th-annual-epa-drinking-water-workshop-small-system-challenges-and-solutions>.

¹⁵¹ <https://www.epa.gov/naaqs/lead-pb-air-quality-standards>.

prioritized critical research needs; identified areas of inter-Agency collaboration and sharing of methods, models, and data; and proposed a set of concrete suggestions of next steps.

American Healthy Homes Survey II: From March 2018 to June 2019, HUD conducted the American Healthy Homes Survey II to determine progress in reducing the prevalence of U.S. homes with lead-based paint hazards, elevated water lead levels, and lead service lines, as well as relevant demographic and economic associations.¹⁵² The final report was released October 2021.

Lead Technical Studies: HUD awarded Lead Technical Studies grants to research agencies, firms, and organizations annually, and awards lead research contracts that evaluate long-term efficacy of residential lead remediation and its impact on children’s cognitive levels. As of April 2024, HUD has 13 active grants, totaling over \$10 million.

Objective 4.2. Establish the Lead Exposure and Prevention Advisory Committee (LEPAC).

Lead Exposure and Prevention Advisory Committee: CDC established the Lead Exposure and Prevention Advisory Committee (LEPAC) in February 2018 in response to the Water Infrastructure Improvements for the Nation Act of 2016.^{153, 154} LEPAC is charged with reviewing federal programs and services available to lead-exposed individuals and communities; reviewing current research on lead poisoning to identify additional research needs; reviewing and identifying best practices, or the need for best practices, regarding lead screening and prevention of lead poisoning; and identifying effective services for individuals and communities affected by lead exposure. The committee has had representation from agencies such as CMS, CPSC, ED, EPA, FDA, HHS, HUD, OSHA, USDA, and USGS. Membership varies as priorities change.

Moving Forward

Developed through cross-governmental collaboration of the President’s Task Force on Environmental Health Risks and Safety Risks to Children, which includes 17 federal departments and offices, the Federal Lead Action Plan is a blueprint for reducing lead exposure and associated harms by working with a range of stakeholders, including states, Tribes and local communities, along with businesses, property owners and parents.

Reducing childhood exposure to lead requires a coordinated federal-wide effort that evaluates the predominant sources of lead and improves identification and treatment of children who are lead exposed. Federal agencies will continue to work in a whole of government way to promote a vision that the U.S. will become a place where children live, learn and play protected from lead exposure and its harmful effects. This vision requires federal agencies to continue to focus on populations facing disproportionate cumulative impacts of environmental, social and health factors.

¹⁵² https://www.hud.gov/sites/dfiles/HH/documents/AHHS%20II_Lead_Findings_Report_Final_29oct21.pdf.

¹⁵³ <https://www.cdc.gov/nceh/lead/advisory/lepac.htm>.

¹⁵⁴ <https://www.federalregister.gov/documents/2018/02/13/2018-02823/lead-exposure-and-prevention-advisory-committee-lepac-notice-of-establishment>.

Appendix 1: Acknowledgments

The Task Force Senior Steering Committee Co-Chairs Leith States (HHS) and Grace M. Robiou (EPA) thank all the federal partners for their efforts and contributions in developing this Progress Report on the *Federal Lead Action Plan: December 2018 – April 2024*. In particular, we acknowledge the work of the Lead Subcommittee, co-chaired by Maureen Gwinn (EPA), Sharunda Buchanan (HHS) and Warren Friedman (HUD). We thank Brooke Holmes (EPA) for her assistance in preparing the report; Daniel Dodgen (HHS), Kimberly Thigpen Tart (HHS), Isabella Bennett (EPA) and Kaythi Han (EPA) for overall communications support. Many other individuals across 15 federal agencies contributed and collaborated to identify the achievements that were most important to feature in federal efforts to reduce exposures to lead and protect the health of children. We thank them for their contributions.

Appendix 2: U.S. EPA Lead Publications 2019-2024

EPA's [Science Inventory](#) is a searchable database of research products primarily from EPA's Office of Research and Development.¹⁵⁵ Science Inventory records provide descriptions of the product, contact information, and links to available printed material or websites. Additional information about each publication listed may be found at Science Inventory.

Appendix 2.1 Blood Lead Level Modeling Publications

Brown, J. S., Spalinger, S. M., Weppner, S. G., Hicks, K. J. W., Thorhaug, M., Thayer, W. C., Follansbee, M. H., & Diamond, G. L. (2022). Evaluation of the integrated exposure uptake biokinetic (IEUBK) model for lead in children. *Journal of exposure science & environmental epidemiology*, 33: 187-197. Advance online publication. <https://doi.org/10.1038/s41370-022-00473-2>.

Brown, J.S., Diamond, G.L. (2023). Derivation of first-order dissolution rates to estimate particle clearance and burden in the human respiratory tract. *Particle and Fiber Tox*, 20(17). <https://doi.org/10.1186/s12989-023-00523-z>.

Diamond, G.L., Thayer, W.C., Brown, J.S., Burgess, M., Follansbee, M.H., Gaines, L.G.T., & Klotzbach, J.M. (2019). Estimates of urinary blood lead clearance and its relationship to glomerular filtration rate based on a large population survey. *J Toxicol Environ Health A*, 82(5): 379-382. DOI:10.1080/15287394.2019.1603280.

Stanek, L., J. Xue, C. Lay, E. Helm, T. Speth, D. Lytle, M. Schock, and V. Zartarian. (2020). Modeled Impacts of Drinking Water Pb Reduction Scenarios on Children's Exposures and Blood Lead Levels. *Environmental Science & Technology*, 54(15): 9474-9482. American Chemical Society, Washington, D.C.. <https://doi.org/10.1021/acs.est.0c00479>.

U.S. EPA. (2019). All-Ages Lead Model (AALM), Version 2.0 (External Review Draft). U.S. Environmental Protection Agency, Washington, D.C.

U.S. EPA. (2020). Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK), Version 2.0. <https://www.epa.gov/superfund/lead-superfund-sites-software-and-users-manuals#guidance>.

Ye, D., Brown, J. S., Umbach, D. M., Adams, J., Thayer, W., Follansbee, M. H., & Kirrane, E. F. (2022). Estimating the Effects of Soil Remediation on Children's Blood Lead near a Former Lead Smelter in Omaha, Nebraska, USA. *Environmental health perspectives*, 130(3): 37008. <https://doi.org/10.1289/EHP8657>.

Zartarian, V.G., Xue, J., Gibb-Snyder, E.*, Frank, J.J., Tornero-Velez, R., & Stanek, L.W. (2023). Children's lead exposure in the U.S.: Application of a national-scale, probabilistic aggregate model with a focus on residential soil and dust lead (Pb) scenarios. *Science of The Total Environment*, 905: 167132. <https://doi.org/10.1016/j.scitotenv.2023.167132>.

Appendix 2.2 Children's and Adult's Soil and Dust Ingestion Rates Publications

EPA STAR Grants: Estimating Children's Soil and Dust Ingestion Rates for Exposure Science. <https://www.epa.gov/newsreleases/epa-awards-over-9-million-research-better-understand-exposure-young-children-chemicals>.

¹⁵⁵ <https://cfpub.epa.gov/si/>.

PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

Hubbard, H., Özkaynak, H., Glen, G., Cohen, J., Thomas, K., Phillips, L., & Tolve, N. (2022). Model-based predictions of soil and dust ingestion rates for U.S. adults using the stochastic human exposure and dose simulation soil and dust model. *The Science of the total environment*, 846: 157501. <https://doi.org/10.1016/j.scitotenv.2022.157501>.

Özkaynak, H., Glen, G., Cohen, J., Hubbard, H., Thomas, K., Phillips, L., & Tolve, N. (2022). Model based prediction of age-specific soil and dust ingestion rates for children. *Journal of exposure science & environmental epidemiology*, 32(3): 472-480. <https://doi.org/10.1038/s41370-021-00406-5>.

Appendix 2.3 Lead and Drinking Water Publications

Bosscher, V., D. Lytle, M. Schock, A. Porter, & M. Deltoral. (2019). POU Water Filters Effectively Reduce Lead in Drinking Water: A Demonstration Field Study in Flint, Michigan. *Journal of Environmental Science and Health, Part A*, 54(5): 484-493.. Taylor & Francis Group, London, UK. <https://doi.org/10.1080/10934529.2019.1611141>.

Bradham, K.D., Nelson, C.M., Sowers, T.D., et al. (2023). A national survey of lead and other metal(oids) in residential drinking water in the United States. *Journal of Exposure Science & Environmental Epidemiology*, 33: 160–167. <https://doi.org/10.1038/s41370-022-00461-6>.

Burkhardt, J.B., Woo, H., Mason, J., Shang, F., Triantafyllidou, S., Schock, M.R., Lytle, D., & Murray, R. (2020). Framework for Modeling Lead in Premise Plumbing Systems Using EPANET. *Journal of Water Resources Planning and Management*, 146(12): 04020094.

Burkhardt, J.B., Woo, H., Mason, J., Shang, F., Triantafyllidou, S., Schock, M.R., Lytle, D., & Murray, R. (2022). Closure to “Framework for Modeling Lead in Premise Plumbing Systems Using EPANET”. *J Water Resources*, 148(2). [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0001304](https://doi.org/10.1061/(ASCE)WR.1943-5452.0001304).

DeSantis, M., Triantafyllidou, S., Schock, M., & Lytle, D.A. (2018). Mineralogical Evidence of Galvanic Corrosion in Drinking Water Lead Pipe Joints. *Environmental Science & Technology*, 52(6): 3365-3374.. American Chemical Society, Washington, D.C. <https://doi.org/10.1021/acs.est.7b06010>.

DeSantis, M.S., Schock, M.R., Tully, J., and Bennett-Stamper, C. (2020). Orthophosphate Interactions with Destabilized PbO₂ Scales. *Environmental Science & Technology*, 54(22): 14302-14311. <https://doi.org/10.1021/acs.est.0c03027>.

Devine, C. and Triantafyllidou, S. (2023). A Literature Review of Bench Top and Pilot Lead Corrosion Assessment Studies. *AWWA Water Science*, 5(2): e1324. John Wiley & Sons, Inc., Hoboken, NJ. <https://doi.org/10.1002/aws2.1324>.

Doré, E., D. Lytle, L. Wasserstrom, J. Swertfeger, and S. Triantafyllidou. (2020). Field Analyzers for Lead Quantification in Drinking Water Samples. *Critical Reviews in Environmental Science and Technology*, 50(20): 1-31. CRC Press LLC, Boca Raton, FL. <https://doi.org/10.1080/10643389.2020.1782654>.

Doré, E., Formal, C., Muhlen, C., Williams, D., Harmon, S., Pham, M., Triantafyllidou, S., and Lytle, D.A. (2021). Effectiveness of point-of-use and pitcher filters at removing lead phosphate nanoparticles from drinking water. *Water Res.*, Aug 1; 201: 117285. Published online 2021 May 25. <https://doi.org/10.1016/j.watres.2021.117285>.

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U.S. EPA. (2023). Water filter effectiveness study, Benton Harbor, MI. <https://www.epa.gov/mi/benton-harbor-michigan-drinking-water-study-results>.

Williams, D., Parrett, C., Schock, M., Muhlen, C., Donnelly, P., and Lytle, D. (2018). Design and Testing of USEPA's Flint Pipe Rig for Corrosion Control Evaluation. *Journal of the American Water Works Association*, 110(10): E16-E37. American Water Works Association, Denver, CO. <https://doi.org/10.1002/awwa.1127>.

Xing, W., E. Cao, K. Scheckel, X. Bai, and L. Li. (2018). Influence of phosphate amendment and zinc foliar application on heavy metal accumulation in wheat and on soil extractability impacted by a lead-smelter near Jiyuan, China. *Environmental Science and Pollution Research*, 25(31): 31396-31406. Ecomed Verlagsgesellschaft AG, Landsberg, Germany. <https://doi.org/10.1007/s11356-018-3126-4>.

Xing, W., Y. Zheng, K. Scheckel, Y. Luo, and L. Li. (2019). Spatial distribution of smelter emission heavy metals on farmland soil. *Environmental Monitoring and Assessment*, 191(2): 115. Springer, New York, NY. <https://doi.org/10.1007/s10661-019-7254-1>.

Lead and Soil 2.4: Bioavailability, Sequestration, Isotopic Tracking

Bradham, K., G. Diamond, C. Nelson, M. Noerpel, K. Scheckel, B. Elek, R. Chaney, Q. Ma, and D. Thomas. (2018). Long-Term in Situ Reduction in Soil Lead Bioavailability Measured in a Mouse Model. *Environmental Science & Technology*, 52(23): 13908-13913. American Chemical Society, Washington, D.C. <https://doi.org/10.1021/acs.est.8b04684>.

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George, S., J. James, R. Devereux, Y. Wan, G. Diamond, K. Bradham, K. Scheckel, and D. Thomas. (2022). Ingestion of Remediated Lead-Contaminated Soils Affects the Fecal Microbiome of Mice. *Science of the Total Environment*, 837: 155797. Elsevier, B.V., AMSTERDAM, Netherlands. <https://doi.org/10.1016/j.scitotenv.2022.155797>.

George, SE, and Wan, Y. (2019). Advances in characterizing microbial community change and resistance upon exposure to lead contamination: Implications for ecological risk assessment. *Critical Reviews in Environmental Science and Technology*, 50(21): 2223-2270. <https://doi.org/10.1080/10643389.2019.1698260>.

Griggs, J.L., Thomas, D.J., Fry, R., and Bradham, K.D. (2021). Improving the predictive value of bioaccessibility assays and their use to provide mechanistic insights into bioavailability for toxic metals/metalloids - A research prospectus. *J Toxicol Environ Health B Crit Rev.*, 24(7): 307-324. <https://doi.org/10.1080/10937404.2021.1934764>.

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Karna, R., Noerpel, M., Luxton, T., and Scheckel, K. (2018). Point of Zero Charge: Role in Pyromorphite Formation and Bioaccessibility of Lead and Arsenic in Phosphate-Amended Soils. *Soil Systems*, 2(2): 22. MDPI AG, Basel, Switzerland. <https://doi.org/10.3390/soilsystems2020022>.

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PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

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Appendix 2.5 Lead Exposure and Health Impacts Publications

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PROGRESS REPORT ON THE FEDERAL LEAD ACTION PLAN: DECEMBER 2018-APRIL 2024

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Appendix 2.6 Lead Exposure Mapping Publications

Xue, J., Zartarian, V., Tornero-Velez, R., Stanek, L. W., Poulakos, A., Walts, A., Triantafillou, K., Suero, M., and Grokhowsky, N. (2022). A Generalizable Evaluated Approach, Applying Advanced Geospatial Statistical Methods, to Identify High Lead Exposure Locations at Census Tract Scale: Michigan Case Study. *Environmental health perspectives*, 130(7): 77004. <https://doi.org/10.1289/EHP9705>.

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