Lead (Pb) Research

ISSUE SUMMARY:

Reducing childhood lead (Pb) exposure is one of EPA's highest priorities. EPA research provides information and tools to help the Agency, states, Tribes, utilities, and communities reduce lead exposure. The EPA Lead Strategy and the "Federal Action Plan to Reduce Childhood Lead Exposures and Associated Health Impacts" guide ORD's lead research. A "Progress Update to the Federal Lead Action Plan" was published in May 2024.

EPA's lead research focuses on:

- Strengthening the scientific basis of the agency's lead-related regulatory and cleanup decisions.
- Advancing the development of environmental monitoring technologies and assessing lead contamination in the air.
- Identifying locations with high potential exposure risks using modeling and mapping strategies while at the same time analyzing data for their primary lead sources.
- Improving drinking water quality across the United States by:
    - Developing methods to identify the presence of lead service lines so that they can be rapidly removed.
    - Evaluating and optimizing corrosion control treatments that reduce the leaching of lead from plumbing materials into drinking water.
    - Providing technical support to municipalities that have identified elevated lead in their drinking water.
    - Estimating the contribution of lead from lead service lines to children's elevated blood levels.

UPCOMING MILESTONES:

- By September 2024, ORD expects to produce a national-scale analysis and several state-specific analyses identifying lead exposure hotspots, based on research in Michigan and other available data (Goal 2 of "FY 2024 EPA Pb Strategy Performance Measures and Milestones").

BACKGROUND:

Modeling Exposure to Lead

It is difficult to estimate how much lead children and adults are exposed to from different exposure pathways because there are many different media containing lead (e.g., dust, soil, water, food, air). EPA researchers addressed children's exposures by harnessing the strengths of two EPA computer models, the Stochastic Human Exposure and Dose Simulation model and the Integrated Exposure Uptake Biokinetic model (the model based on elements of both of these is termed SHEDS-Pb) to understand the relationship between lead levels in children's blood and lead concentrations in drinking water, soil, dust, and other sources. SHEDS-Pb modeling analyses and three published journal articles supported Agency actions to update the Lead and Copper Drinking Water Rule and Dust Lead Hazard Standard, and are also informing the U.S. Department of Housing and Urban Development's (HUD's) soil-lead guidance update. In addition, the IEUBK model was further refined, evaluated, and applied by various stakeholders.

EPA researchers address adults' and children's exposures through the All-Ages Lead Model (AALM), which 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. The AALM was also utilized to inform agency rulemakings and guidance to address lead exposures from different environmental media.

EPA recently updated AALM to address peer review comments from the Science Advisory Board (SAB). In addition, to help reduce uncertainty in human health risk assessments, EPA researchers published several papers on soil and dust ingestion rates for children and adults. These updated rates are being used in the available lead models.

Identifying Communities at Risk for Lead Exposure

While blood lead levels overall have dropped significantly in recent decades, some communities still face disproportionate exposure risks. Unfortunately, data gaps make it challenging to identify where these communities are located across the larger landscape, preventing actions to reduce these risks and leaving the children who live there at greater risk to serious health effects, including lead poisoning.

EPA researchers are working to change that. In an innovative, multi-disciplinary, cross federal government research effort, lead modeling and mapping methodologies are under development to pinpoint areas at the U.S. Census tract scale with a high prevalence of lead exposure risk. EPA researchers are also using what they learn to develop a step-by-step "blueprint" for identifying high lead exposure locations to aid EPA regions and state partners to build their own capacity to conduct similar analyses and guide preventative actions. This work will help EPA continue to advance its modeling and mapping science for lead so that states and communities have the information they need to target and prioritize actions to reduce, prevent, and mitigate lead exposure risk, particularly for children.

In addition to publishing research papers that analyze high potential lead exposure locations in several states, EPA, HUD, the Centers for Disease Control and Prevention, and the Agency for Toxic Substances and Disease Registry 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 modeling, mapping, federal collaborations, and remaining challenges; and a U.S. lead exposure modeling and mapping analysis. (epa.gov/lead/mapping)

Working with Communities to Solve Lead Issues in Drinking Water

EPA continues to provide technical support to states and communities to help reduce exposure to lead from plumbing sources, and to help prevent elevated lead problems that could result from changes in water quality source and treatment processes. EPA researchers provided technical support in collaboration with the scientific expertise of EPA's Office of Water, EPA Region 2, the New Jersey Department of Environmental Protection, and the City of Newark, New Jersey in assessing point-of-use filtration for lead contaminated drinking water. Similarly, EPA researchers supported Region 5, the Office of Water, and the State of Michigan by sampling homes in Benton Harbor, Michigan to confirm the effectiveness of water filters in reducing lead levels in water. EPA researchers also

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provided technical support to multiple communities around the country in assessing corrosion control methods and identifying sources of lead contamination in municipal drinking water. EPA continues to develop lead and copper water sampling methods to identify lead service lines, assess exposure, and support sampling in schools. EPA researchers worked with Office of Water and EPA Region 5 to estimate the contribution of lead services lines to children's elevated blood lead levels in two Midwest communities.

Support for the Drinking Water State Revolving Fund (DWSRF) Lead Service Line Replacement Funding Program

EPA researchers provide technical assistance to the agency, the states, and communities in furtherance of EPA's administration of DWSRF program funding for lead service line replacement and associated activities, such as inventories. (Please see OW briefing paper *Water, Wastewater, and Stormwater Infrastructure Funding* for more information on DWSRF.) EPA researchers are evaluating commercially available and emerging innovative technologies to determine which ones can rapidly, accurately, and cost effectively identify where lead pipes that deliver water to homes and buildings are buried, furthering EPA's effective administration of this funding. States and communities need this information to identify where the estimated 6-10 million remaining lead service lines are located across the country and to more efficiently utilize available DWSRF funding for inventories, identification, and replacements. These technologies include water sampling, predictive machine learning models, metal detectors, and more, and they will be tested in the lab, in testbeds, and in communities. The results of this effort will be made accessible to water systems through guidance, apps, and websites.

Lead Integrated Science Assessment (ISA)

In January 2024, EPA released the Integrated Science Assessment (ISA) for lead. This ISA synthesizes the science examining the relationships between lead exposures and human health or ecosystem effects. The lead ISA supports 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.

KEY EXTERNAL STAKEHOLDERS:

☒ Congress ☐ Industry ☒ States ☒ Tribes ☐ Media ☒ Other Federal Agency
☒ NGO ☒ Local Government ☐ Other (Local unions)

States, Tribes, and local governments need information to make decisions to protect people when lead is found in drinking water. Congress, NGOs, and the media are interested in this work as well.

MOVING FORWARD:

- EPA researchers will continue to develop and evaluate treatment strategies in drinking water, including both soluble and particulate lead.
- EPA researchers will work with EPA Regions and states to use lead exposure models and maps and other data (e.g., blood level lead data) for focusing actions.

- EPA researchers will continue evaluating lead levels and the bioavailability of lead in water, soil, and dust samples from the American Healthy Homes Survey.
- EPA researchers will continue to provide scientific support for EPA's rulemakings and interagency guidance.
- EPA researchers will continue to refine strategies to identify lead service lines for replacement.

LEAD OFFICE/REGION: ORD OTHER KEY OFFICES/REGIONS: OW, REGION 5, OLEM, OCSPP