WISCONSIN

Childhood Lead Poisoning

Prevention and Control Handbook

For Local Public Health Departments

Wisconsin Childhood Lead Poisoning Prevention Program
608-266-5817

Revised November 2014

Wisconsin Department of Health Services (P-00660, 11/2014)

ACKNOWLEDGEMENT

The Wisconsin Childhood Lead Poisoning Prevention Program extends a heartfelt thank-you to those who reviewed and provided valuable feedback during the comprehensive revision of our handbook.

November 2014

Wisconsin Childhood Lead Poisoning Prevention and Control Handbook For Local Health Departments

Table of Contents

Chapter 1 The Wisconsin Childhood Lead Poisoning Prevention Program and Public Health Improvement Initiatives

Chapter 2 Standards and Legislation on Lead Hazards and Exposure

Chapter 3 Toxicology, Societal Costs of Lead Exposure, Sources and Routes of Lead Exposure

Chapter 4 Primary Prevention and Educating for Behavior Change

Chapter 5 Screening and Diagnosis of Childhood Lead Poisoning

Chapter 6 Nursing Case Management of a Child with Lead Poisoning

Chapter 7 Environmental Assessment and Intervention for a Child with Lead Poisoning

Chapter 8 Medical Management of Childhood Lead Poisoning

Chapter 9 Nutrition and Childhood Lead Poisoning

Chapter 10 Developmental Assessment and Intervention for a Child with Lead Exposure

Chapter 11 Lead Toxicity and Reproductive Health, Pregnant and Lactating Women and Fetal and Infant Development

Chapter 12 Reimbursement for Services to Children with Lead Poisoning Enrolled in the Wisconsin Medicaid Program

Appendix A Forms

Appendix B Samples for Environmental Investigation and Lead Hazard Reduction

Chapter 1

Wisconsin Childhood Lead Poisoning Prevention Program and Public Health Improvement Initiatives

Contents

Introduction 1.2

Core Functions of Wisconsin Public Health Departments 1.2

Wisconsin Childhood Lead Poisoning Prevention Program 1.4

Consolidated Contracts with Local Health Departments for Childhood Lead Poisoning Prevention Activities 1.5

Federal and State Public Health Improvement Initiatives 1.8

Introduction

Childhood lead poisoning is an environmental disease, whose treatment and prevention requires the collaboration of the affected family with private and public health professionals. Public health is central in addressing all components of this childhood disease, including prevention of exposure, treatment, and surveillance. This chapter describes the functions of the state and local public health departments in Wisconsin, as well as federal agencies closely aligned with public health interests. It is the role of public health departments to mobilize resources at the local, county, state and national level to increase community resources to prevent childhood lead poisoning. The Wisconsin Childhood Lead Poisoning Prevention Program (WCLPPP) is organizationally located within the Department of Health Services (DHS), Division of Public Health (DPH), Bureau of Environmental and Occupational Health (BEOH).

Core Functions of Wisconsin Public Health Departments

Wisconsin state and local public health department activities in childhood lead poisoning are best described within the framework of the core public health functions of assessment, policy development and advocacy/assurance. These functions are defined in Wis. Stat. 250.
The core public health functions as defined by statute, and specific public health practices and activities that clarify the role of the state and local health departments (LHDs) in childhood lead poisoning prevention (CLPP) and treatment, are summarized below in Tables 1.1 Public Health Assessment, 1.2 Public Health Policy Development, and 1.3 Public Health Advocacy/ Assurance. The extent to which state and local public health agencies can fulfill these core functions may vary based on resource availability.

Table 1.1 Public Health Assessment

State Department of Health Services	Local Health Department
"Assess the health needs in the state based on statewide data collection." Wis. Stat. 250.03(1)(c) Assessment of childhood lead poisoning: • Collect, consolidate, evaluate, and disseminate data/information pertaining to the incidence and prevalence of lead poisoning in populations at risk. • Maintain a central case registry of children with reported blood lead levels. • Submit reports to appropriate federal, state, and local agencies/organizations. • Provide technical assistance to LHDs for local forecasting, interpretation, planning, and evaluation.	"A local board of health shall: assess public health needs and advocate for the provision of reasonable and necessary public health services." Wis. Stat. 251.04(6)(a) LHD shall: “regularly and systematically collect, assemble, analyze, and make available information on the health of the community, including statistics on health status, community health needs, and epidemiological and other studies of health problems." Wis. Stat. 251.05(3)(a) Assessment of childhood lead poisoning: • Establish and maintain a local surveillance system to track blood lead levels (BLLs), incidence and prevalence of lead poisoning, trends in testing, and identify high risk populations. • Conduct timely investigations and interventions for children with lead exposure. • Maintain a tracking system of children at risk or diagnosed with lead poisoning that allows for timely follow-up of interventions and referrals. • Submit reports to DHS via WCLPPP. • Coordinate program efforts with local laboratories and health care providers to assure timely and accurate reporting of blood lead tests and to assure that appropriate medical follow-up is provided. • Analyze data in conjunction with DHS/DPH to determine local trends and effectiveness in lead poisoning prevention and control efforts.

Table 1.2 Public Health Policy Development

State Department of Health Services	Local Health Department
"Develop policy and provide leadership in public health throughout the state that fosters local involvement and commitment, that emphasizes public health needs and that advocates for equitable distribution of public health resources and complimentary private activities commensurate with public health needs." Wis. Stat. 250.03(1)(g) "Distribute state and federal public health funds under its control in a manner that will promote the development and maintenance of an integrated system of community health services." Wis. Stat. 250.03(1)(h) Policy Development for CLPP: • Advise and carry out state statutes, administrative rules, and federal policy as it pertains to lead poisoning prevention and control. • Establish program standards and guidelines for community lead poisoning prevention programs that include screening, follow-up, lead hazard identification and reduction. • Collaborate with LHDs, community organizations, and health care providers in delineating respective roles and responsibilities for prevention and control. • Facilitate the development of contemporary prevention and control policies and practices. • Work collaboratively within DPH and with other agencies to foster program linkages and to implement state and federal policies. • Inform LHDs of resources for prevention services including Medicaid and housing rehabilitation funds.	"A local board of health shall: develop policy and provide leadership that fosters local involvement and commitment, that emphasizes public health needs and that advocates for equitable distribution of public health resources and complimentary private activities commensurate with public health needs." Wis. Stat. 251.04(6)(b) "LHD shall: develop public health policies and procedures for the community." Wis. Stat. 251.05(3)(b) Policy Development for CLPP: • Develop protocols and procedures for assuring and monitoring the screening of children less than six years of age within their jurisdiction based on federal and state guidelines. • Establish program protocols and procedures for clinical, educational, and environmental services that incorporate federal, state, and local laws, standards, and guidelines that assure quality programming. • Provide leadership to develop a coordinated local system to prevent childhood lead poisoning for the population served. • Pursue and secure resources, including housing funds, to provide prevention services to target populations. • Work with local officials to develop, revise, and implement local ordinances to prevent lead poisoning. • Carry out state statutes and administrative rules if designated to do so by DHS, Wis. Stat. 254.015 • Work collaboratively with other organizations, health care providers, and individuals in the public, private, and voluntary sectors.

Table 1.3 Public Health Advocacy/Assurance

State Department of Health Services	Local Health Department
"Advocate for the provision of reasonable and necessary public health services." Wis. Stat. 250.03(1)(j) Advocacy for CLPP: • Develop and carry out strategies that focus on high risk sub-population groups in the state. • Provide data, consultation and technical assistance to LHDs, community organizations, and health care providers. • Provide education, training, and related resources to LHDs as requested. • Provide information and develop and disseminate education resources to public, private, or volunteer organizations and individuals as appropriate and as requested. • Provide federal, national, and state materials and literature to LHDs for distribution within their communities. • Sponsor educational seminars for LHDs, community organizations, and health care providers. • Develop or provide multi-lingual and culturally appropriate educational materials as needed. • Coordinate program efforts with the Wisconsin State Laboratory of Hygiene and the State Occupational Health Laboratory to assure provision of analytical services. • Identify resources to sustain laboratory analysis, reporting, and prevention programming. • Evaluate effectiveness of state and local prevention and control programs.	"A local board of health shall assure that measures are taken to provide an environment in which individuals can be healthy." Wis. Stat. 251.04(7) "LHD shall: involve key policy makers and the general public in determining a set of high priority public health services and assure access to these services to every member of the community." Wis. Stat. 251.05(3)(c) Advocacy for CLPP: • Provide family-centered public health nursing follow-up for families with lead poisoning. • Provide environmental investigation and follow up for lead hazard reduction by a certified risk assessor. • Provide education, training, and related resources to the community as appropriate. • Develop and carry out primary prevention strategies that focus on high-risk groups in the community. • Disseminate national, federal, and state information and resources to health care providers, organizations, and the general community, as appropriate. • Provide leadership that fosters coordination of public health nursing, environmental health, and medical services for children with lead poisoning. • Collaborate with local health care providers in delineating roles and responsibilities regarding the health and medical management of children with lead poisoning. • Evaluate local program effectiveness and participate in state level program evaluation. • Seek consultation from DPH as appropriate.

Wisconsin Childhood Lead Poisoning Prevention Program

The WCLPPP works collaboratively with other programs within DPH, and public health nurses, nutritionists, educators, epidemiologists and environmental health specialists/sanitarians. The WCLPPP staff also works with the DHS Office of the Inspector General, Division of Enterprise Services, Division of Health Care Access and Accountability, and Division of Information Technology, the Department of Administration, including the Division of Housing and the Weatherization Programs, the University of Wisconsin-Madison School of Medicine and Public Health, Wisconsin State Laboratory of Hygiene, Department of Children and Families, Department of Public Instruction, and other state and local agencies and organizations.

The WCLPPP is committed to developing partnerships with public health programs, and to expanding collaboration between public sector agencies and private and voluntary sectors to eliminate childhood poisoning by controlling lead hazards in the environment.
The roles and functions of WCLPPP are to:

- Implement Wisconsin statutes, especially Wis. Stat. 254, and to develop and implement administrative rules, as needed.
- Develop and implement a comprehensive statewide lead poisoning or lead exposure prevention and treatment program.
- Provide consultation, technical support, recommendations and standards of practice for preventing childhood lead exposure, treatment of lead-exposed children and control of lead hazards.
- Develop and support efforts by LHDs and other entities to identify sources of lead exposure and to reduce lead exposure and resultant morbidity.
- Develop local lead poisoning prevention programs that afford opportunities for employing residents of communities and neighborhoods affected by lead exposure.
- Seek funding for lead poisoning prevention activities.
- Develop educational programs to communicate to parents, educators, officials of local boards of health and others the health dangers of lead exposure from lead-bearing paint.

The WCLPPP is funded by the state general purpose revenue fund and the federal Maternal and Child Health Block Grant. The following are services and activities conducted by program staff:

- Collect and analyze data to track statewide lead poisoning patterns.
- Support laboratory analysis of environmental and biological lead samples, with priority given to those who are uninsured.
- Provide consultation and technical assistance to LHDs in managing difficult cases/ investigations.
- Provide information and training to the public, LHDs and health care providers regarding current guidelines and recommendations.
- Assure compliance with Wisconsin's statutes as they pertain to lead poisoning prevention and control.
- Provide education and training in screening, nursing practice, environmental lead hazard investigations, recommendations for controlling lead hazards, and assistance with certification and training for lead-related disciplines.
- Contract with LHDs to provide local childhood lead poisoning prevention services and activities.

Consolidated Contracts with Local Health Departments for Childhood Lead Poisoning Prevention Activities

Wis. Stat. 254.151 requires that DHS shall designate LHDs as agents in administering and enforcing the statute and award grants sufficient to carry out these responsibilities. DHS contracts with LHDs via an annual consolidated contract to procure key public health services at the local level.

Some of the elements of the consolidated contract are:

- Data-driven allocation of funds based on population, housing and epidemiological risk factors.

- Programs focused on local needs and objectives that are locally defined.
- Fiscal responsibility provided by LHD, along with a wide variety of options for involvement and management of all public health programs in its jurisdiction.
- Funding structure with outcomes that are clearly defined, measurable, and of value to the local community.
- Increased financial efficiency at the state and local level.

Criteria for the delivery of high quality and cost-effective administration of health care programs are required in each LHD program to be operated under the terms of this consolidated contract. The WCLPPP Consolidated Contracts Advisory (CCA) Committee, consisting of state and local health department staff, developed program-specific criteria for each of the nine Program Quality Criteria categories (see Table 1.4). The program quality criteria are considered essential for delivery of effective services in a local childhood lead poisoning prevention program. LHDs contracting for funds from DHS are expected to be able to achieve these criteria.

Table 1.4 Program Quality Criteria for the DHS WCLPPP Consolidated Contracts

Program Quality Criteria	Childhood Lead Poisoning Prevention Activities
Assessment and surveillance of public health to identify community needs and to support systematic, competent program planning and sound policy development with activities focused at both the individual and community levels.	Contractees must assess local blood lead surveillance data for lead poisoning prevalence and risk factors.
Delivery of public health services to citizens by qualified health professionals in a manner that is family centered, culturally competent, and consistent with best practices; and delivery of public health programs for communities for the improvement of health status.	Contractees must provide services that support the elimination of childhood lead poisoning, and the early detection and treatment of children with lead poisoning, including compliance with: (1) Wis. Statute and Administrative Rules: • Wis. Stat. 254 • Wis. Admin. Rule DHS 181 • Wis. Admin. Rule DHS 163 (2) Practice standards presented in Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention Contractees must assure the availability and accessibility of blood lead tests for children ages 0-5 years at high risk for lead poisoning.
Record keeping for individual-focused services that assure documentation and tracking of client health care needs, response to known health care problems on a timely basis, and confidentiality of client information.	Maintain a central case registry to track follow-up of children with blood lead levels ≥5 mcg/dL and of properties where a lead hazard investigation was performed, including findings, interventions and outcomes.
Information, education, and outreach programs intended to address known health risks in the general and certain target populations to encourage appropriate decision making by those at risk and to affect policy and environmental changes at the community level.	Provide information to one or more target audiences within the community about lead hazards, lead hazard reduction methods, primary prevention of lead poisoning, and blood lead testing, as referenced in the boundary statement, which sets the parameters of the program within which the LHD/tribe/agency needs to set its objectives..

Table 1.4 Program Quality Criteria for the DHS WCLPPP Consolidated Contracts

Program Quality Criteria	Childhood Lead Poisoning Prevention Activities
Coordination with related programs to assure that identified public health needs are addressed in a comprehensive, cost-effective manner across programs and throughout the community.	Build partnerships with local health care providers and agencies involved in health, social services, housing, and child care to incorporate lead hazard awareness into their activities with, or services to, families living in pre-1978 housing. Provide information, consultation and technical assistance to health care providers or other programs to assure that treatment of children with lead poisoning is efficient and effective, and to assure that lead-safe environments are available to children.
A referral network sufficient to assure the timely provision of services to address identified client health care needs.	Assess the need for, and provide referrals for, supportive services to families of lead-poisoned children.
Provision of guidance to staff through program and policy manuals and other means sufficient to assure quality client care and cost-effective program administration.	Assure that local childhood lead poisoning prevention program staff have access to, are knowledgeable of and are in compliance with the state statutes and administrative rules and practice standards.
Financial management practices sufficient to assure accurate eligibility determination, pursuit of third-party insurance and Medicaid coverage of services provided, prompt and accurate billing and payment for services provided and purchased, accurate expenditure reporting, and appropriate use of state and federal funds.	Pursue third party payment and/or other funding sources for service provision to children who are eligible for third party payment, except when doing so is demonstrated to not be cost effective.
Data collection, analysis, and reporting to assure program outcome goals are met or to identify program management problems that need to be addressed.	Collect/analyze local data to determine the adequacy of blood lead testing for children, collect timely follow-up of lead-poisoned children and lead hazard reduction work and submit the necessary forms, and provide community lead poisoning prevention education.

The WCLPPP CCA Committee also developed a risk-based formula to disseminate funds from the Wisconsin Legislature for LHD childhood lead poisoning prevention activities listed in Table 1.4. The risk factors that are used to determine a local jurisdiction allocation are listed in Table 1.5.

Table 1.5 Risk Factors for WCLPPP Funding Formula

Risk Factor (within LHD jurisdiction)	Percent Apportioned to Risk Factor
Number of children ages 0 to 5	5
Number of children ages 0 to 5 enrolled in Medicaid	25
(3-Year average number of BLLs greater than or equal to 10 mcg/dL) plus (3-Year average number of elevated BLLs) multiplied by 3. (Elevated BLL = “one venous BLL greater than or equal to 20 mcg/dL or two venous BLLs 15-19 mcg/dL drawn at least 90 days apart)	25
Number of pre-1950 dwellings multiplied by the percent of children ages 0 to 5 enrolled in Medicaid	45

The WCLPPP CCA Committee also developed a Boundary Statement. The boundary statement sets the parameters of the program within which the LHD/tribe/agency will need to set its objectives, including:

- **Scope of Objectives** – Local childhood lead poisoning prevention programs are to implement objectives that will protect children against lead poisoning and eliminate it as a major childhood disease. The impact of LHD/agency activities should result in decreasing lead hazards in the environment(s) of children and increasing early detection and treatment of lead poisoning in high-risk children.
- **Target Populations** – High-risk children generally include those 0-5 years of age who are enrolled in Medicaid and/or WIC or live in housing built before 1950.
- **Community Partners –** Education activities are to be targeted at community members who play a role in eliminating lead hazards, preventing lead exposure, providing blood lead testing, or providing medical or environmental follow-up to children who are lead poisoned.

Each year the LHD selects a template objective(s) or creates a unique objective(s) determined by the LHD to be relevant to their community, and achievable for the amount of funding they receive. The objectives can be entered in the Grants and Contracts (GAC) system if the LHD desires, but is not required; objective negotiations are not required at this time. The objective deliverables, indicating attainment of the objective, should be kept on file in the LHD's records. Submission of mid-year and end-of-year reports is not required at this time.
The boundary statement and template objectives are reviewed and modified annually by WCLPPP staff. The documents are housed in the DHS Grants and Contracts system.

Federal and State Public Health Improvement Initiatives

Federal Public Health Improvement Plan – Healthy People 2020

(Healthy People 2020: National Health Promotion and Disease Prevention Objectives, DHHS/PHS)
Reducing exposure to toxic substances and hazardous wastes is fundamental to environmental health. People spend most of their time at home, work, or school. Some of these environments may expose people to indoor air pollution, structural problems, and lead-based paint hazards. These hazards can impact health and safety. Maintaining healthy homes and communities is essential to environmental health.
Prevention of exposure to environmental hazards relies on many partners, including state and local health departments. Personnel, surveillance systems, and education are important resources for investigating and responding to disease, monitoring for hazards, and educating the public. Additional methods and greater capacity to measure and respond to environmental hazards are needed.

Healthy People 2020 Objectives Related to Lead Exposure

Within the context of federal health strategy, childhood lead poisoning is addressed in the objectives under Environmental Health and Occupational Health and Safety.

- **Environmental Health – Health Status Objective**
  EH-8. Reduce blood lead levels in children (1. Eliminate elevated blood lead levels, and 2. Reduce the mean blood lead level).

  EH-17. (Developmental) Increase the proportion of persons living in pre-1978 housing that has been tested for the presence of lead-based paint or related paint-lead, dust-lead, and soil-lead hazards.

EH-18. Reduce the number of U.S. homes that are found to have lead-based paint or related hazards (Reduce the number of homes with 1.Lead-based paint, 2. Paint-lead hazards, 3. Dust-lead hazards, and 4. Soil-lead hazards).

EH-20.3. Reduce exposure to lead in the population, as measured by blood and urine concentrations of the substance or its metabolites.

EH-22.1. Increase the number of states, territories, tribes, and the District of Columbia that monitor diseases that can be caused by exposure to lead.

- **Occupational Safety and Health – Risk Reduction Objective**
  OSH-7. Reduce the proportion of persons who have elevated blood lead concentrations from work exposures.

Wisconsin Public Health Improvement Plan – Healthiest Wisconsin 2020

Healthiest Wisconsin 2020 (HW2020): Everyone Living Better, Longer represents the third decade of statewide community health improvement planning designed to benefit the health of everyone in Wisconsin and the communities in which we live, play, work, and learn. HW2020 declares a bold vision, "Everyone living better, longer."

This vision reflects the plan's twin goals:

- Improve health across the life span.
- Eliminate health disparities and achieve health equity.

The plan's mission is to assure conditions in which people can be healthy, and members of healthy, safe, and resilient families and communities. Preventing childhood lead poisoning and creating lead-safe environments for children and their families, as public health interventions, fall within the context of the plan's mission.

HW2020 includes a focus area in environmental and occupational health. Environmental and occupational health includes the broad and diverse suite of interrelated regulatory and educational programs and services needed in every Wisconsin community to prevent, identify, and mitigate illnesses and injuries resulting from hazards in the natural, built, and work environments. Environmental and occupational health practice requires close collaboration with environmental and public health system partners to achieve and maintain the healthy places required for healthy living.

Healthiest Wisconsin 2020 Objectives Related to Lead Exposure

Objective 1: By 2020, improve the overall quality and safety of the food supply and the natural, built and work environments.

Objective 2: By 2020, increase the percentage of homes with healthy, safe environments in all communities. (Safe environments are free from lead paint hazards, mold or moisture damage, environmental tobacco smoke and safety hazards, and include carbon monoxide and smoke detectors, and radon testing and mitigation.) Reducing exposure to environmental lead is largely addressed in the Environmental and Occupational Focus Area of HW2020. However, preventing lead exposure in childhood or occupationally can avoid lifelong learning, behavior and health problems reflected in other health focus areas of HW2020. For example, chronic diseases – such as heart disease, stroke, cancer, diabetes, asthma and arthritis – are among the most common and costly of all health problems in the United States (National Center for Chronic Disease Prevention and Health Promotion, 2009b).

Chapter 2

Standards and Legislation on Lead Hazards and Exposure

Contents

In Brief: Summary of the Federal and State Environmental Standards for Lead 2.2

Introduction 2.4

Federal Agency Stakeholders in Childhood Lead Poisoning Prevention 2.4

Federal Standards for Lead 2.6

Federal Legislation on Lead Hazard Reduction 2.8

Wisconsin Statutes and Administrative Codes 2.9

- Department of Health Services 2.9
- Department of Children and Families 2.11
- Department of Agriculture, Trade and Consumer Protection 2.12
- Department of Natural Resources 2.12

In Brief: Summary of the Federal and State Environmental Standards for Lead

FEDERAL STANDARDS

Agency*	Focus	Level**
CDC	Children's Blood	5 mcg/dL (In 2012, CDC called this a reference level)
CPSC	Paint and surface coatings Children's products	90 ppm (0.009%) 90 ppm (surface coatings) 100 ppm (accessible parts)
EPA	Air	1.5 mcg/m^3 for general population, as a 24-hour time-weighted average.
OSHA	Air	30 mcg/m^3 is an action level requiring employers to take action for workers exposed as an 8-hour time-weighted average. 50 mcg/ m^3 is the maximum permissible exposure level for workers exposed as an 8-hour time- weighted average.
EPA	Water	15 ppb
EPA/HUD	Lead in paint Floors (dust) Window sills (dust) Window troughs (dust) Lead in soil in play areas Lead in soil in non-play areas of residential yards Lead Paint Hazards	5000 ppm or 1.0 mg/cm^2 40 micrograms per square foot (mcg/ft2) 250 mcg/ft2 400 mcg/ft2 clearance only 400 ppm 1200 ppm Lead-based paint that is either deteriorating or present on friction, impact or accessible surfaces or lead in dust or soil higher than the federal standards (shown above)
FDA	Bottled water Juice Candy Dishware	5 ppb 50 ppb 100 ppb Varies by type of dishware
OSHA	Worker's Blood Lead Levels	50 mcg/dL – medical removal from exposure 40 mcg/dL – increased monitoring Less than 40mcg/dL – return to work

***Agency:** CDC = Centers for Disease Control and Prevention, CPSC = Consumer Product Safety Commission, EPA = Environmental Protection Agency, OSHA = Occupational Safety and Health Administration, HUD = Housing and Urban Development

****Level:** mcg/dL = micrograms per deciliter, mcg/m^3 = micrograms per cubic meter, ppm = parts per million, ppb = parts per billion, mcg/ft^2 = micrograms per square foot, mg/cm^2 = milligrams/square centimeter

WISCONSIN STATE REGULATIONS

Statute/ Code*	Focus	Level**
DHS 254	Children's Blood Lead in Paint	5-19 mcg/dL – high risk exposure (254.156 requires Wisconsin to adopt CDC definitions of lead poisoning or lead exposure.) 20 mcg/dL or repeat levels of 15-19 mcg/dL at least 90 days apart = elevated blood lead level requiring investigation 0.7 mg/cm^2 dry paint; 600 ppm (0.06%) wet paint
DHS 163	Certified Contractors	Activities involving lead-based paint are done safely without creating or increasing lead hazards.
DHS 181	Reporting of Blood Lead Tests	Rules ensure the timely reporting to the DHS of all tests made to determine the blood lead level of a person.
DHS 182	Lead Poisoning Prevention Grants	Establish criteria and procedures for the award of annual general purpose revenue project grants to local health departments for work to prevent lead poisoning or exposure to lead.
DHS 157	Radiation Protection	Regulates use of X-ray Fluorescence (XRF) devices by a certified professional in a lead hazard investigation or risk assessment.
DHS 134	Facilities Serving People with Developmental Disabilities	❒ Physical environment, ceilings and walls kept clean and in good repair ❒ Interior and exterior of the buildings painted or stained as needed to protect the surfaces ❒ Loose, cracked or peeling wallpaper or paint replaced or repaired ❒ Use lead-free paint inside the facility and remove or cover any surfaces containing lead-based paint that are accessible to residents.
DCF 202, 250-252	Child Care Facilities/ Day Camps	❒ No chipping and peeling paint; free of hazards ❒ No recalled products ❒ Notification before any remodeling activity begins
DCF 56	Foster Care Homes	Maintained in state of good repair: Unsafe building parts shall be promptly repaired
ATCP 134	Residential Rental Code	Property owner shall disclose any condition of the dwelling which constitutes a health hazard
ATCP 704	Landlord and Tenant Code	Conditions under which a tenant may move without incurring liability due to untenantability, including health hazards
ATCP 709	Disclosure by Owners	Disclosure of lead in real estate for sale in Wisconsin
DNR	Drinking Water	Must be less than 15 ppb

***Statute/Code:** DHS = Department of Health Services, DCF = Department of Children and Families, ATCP = Agriculture, Trade and Consumer Protection, DNR = Department of Natural Resources

****Level:** mcg/dL = micrograms per deciliter, mcg/m^3 = micrograms per cubic meter, ppm = parts per million, ppb = parts per billion, mcg/ft^2 = micrograms per square foot, mg/cm^2 = milligrams/centimeter squared

Introduction

A number of federal and state regulations and laws provide the infrastructure within which lead hazard reduction and childhood lead poisoning prevention activities operate. At the national level, the U.S. Centers for Disease Control and Prevention, Consumer Product Safety Commission, Department of Housing and Urban Development, Environmental Protection Agency, Food and Drug Administration, and the Occupational Safety and Health Administration all play roles in regulating the presence of lead in our environments. The roles these agencies play and the areas they regulate are described in this chapter.

At the state level, Wisconsin Statutes and Administrative Codes, through the Department of Health Services, Department of Agriculture, Trade and Consumer Protection, Department of Children and Families and Department of Natural Resources, strengthen federal legislation and assist Wisconsin citizens in protecting themselves against lead hazards.

Federal Agency Stakeholders in Childhood Lead Poisoning Prevention

Centers for Disease Control and Prevention (CDC) – Since 1991, most of the activities of the Wisconsin Childhood Lead Poisoning Prevention Programs (WCLPPP) have been supported with funding from the CDC. The CDC funds provide program infrastructure at the state level in the following areas:

- Strategic elimination plan
- Primary prevention
- Case coordination/plan of care
- Strategic partnerships
- Surveillance
- Policy

The CDC CLPP website¡En Español is extremely useful for data and other resources.

Consumer Product Safety Commission – The CPSC is the federal regulatory body tasked with protecting children and families from unreasonable risks of injuries associated with consumer products. To achieve the CPSC's broad mission of protecting the public against unreasonable risks of injury from consumer products, the Commission focuses on public education, safety standards activities, regulation, and enforcement. CPSC was instrumental in identifying products meant for children that contained dangerous levels of lead, including toys, apparel, furniture, jewelry, foods, lunchboxes, sidewalk chalk, ceremonial products and home remedies, to name a few. Many of these products are imported or brought to the U.S. from foreign countries. The CPSC has done a lot of work with these countries to promote safe manufacturing practices and the number of products recalled for containing lead has decreased significantly. They maintain a website with a searchable database for products that contain lead and other harmful metals in consumer products.

Housing and Urban Development – Grants from the HUD Office of Healthy Homes and Lead Hazard Control¦En Español have funded Wisconsin's Lead Hazard Reduction (LHR) Program through various state agencies including: (1) Department of Commerce, Division of Housing; (2) Department of Administration, Low-Income Weatherization Programs; and (3) DHS, Division of Public Health (DPH). The grants are distributed through partnerships with local public health agencies and community-based organizations. Several Wisconsin communities have also sought and received grants from HUD for lead hazard reduction: the cities of Milwaukee, Racine, Sheboygan, and Waukesha and counties of Kenosha and Rock, and the Social Development Commission in Milwaukee.

HUD grants require regular reporting on the appropriate use of funds, public education, training lead workers and contractors, identification of lead hazards, number of low to moderate income families (including children) enrolled in the program, and number of dwelling units with lead hazards corrected.

Environmental Protection Agency – The EPA regulates real estate disclosure of the presence of lead in housing in the case of sales transactions and signing rental contracts or leases. EPA also regulates renovation, repair and painting activities in dwellings built before 1978. The EPA provides funding to the Asbestos and Lead Certification Unit in the Bureau of Environmental and Occupational Health, DPH, DHS, to oversee the training and certification of all lead disciplines including inspectors, hazard investigators, risk assessors, sampling technicians, lead abatement workers, lead abatement supervisors and lead-safe renovators. More details below.

Lead Safe Renovators are the largest group of state-certified lead workers in Wisconsin. The Wisconsin Lead-Safe Renovator program regulates training and certification of lead workers to assure that:

1. Training providers are accredited before offering lead-safe renovation training.
2. Renovation, repair and painting activities in older homes are done safely.
3. Renovation work practices and standards follow federal and state law and regulations.

The EPA website is a good resource and has information in both English and Spanish.

The National Lead Information Center (NLIC; 1-800-424LEAD) operates under contract with the EPA, with funding from EPA and HUD, to provide the general public and professionals with information about lead, lead hazards, and their prevention.

Food and Drug Administration – The FDA regulates the presence of lead in food, cosmetics, and other products such as dishware. The FDA website¦En Español has a searchable database for products recalled due to dangerous levels of lead. The website also provides information about a rapid lead screening test using a Lead Care II Blood Lead Test system.

Occupational Safety and Health Administration – OSHA's mission is to assure safe and healthful workplaces by setting and enforcing standards, and by providing training, outreach, education and assistance. Employers must comply with all applicable OSHA standards. Employers must also comply with the General Duty Clause of the OSHA Act, which requires employers to keep their workplace free of serious recognized hazards (see Occupational Safety and Health Administration¦En Español).

Federal Standards for Lead

Paint Standards

In 2010, the Consumer Product Safety Commission limited the lead in residential paint to 0.009 percent (90 ppm by dry weight). Paint for bridges, marine, and other use may contain greater amounts of lead.

In Wisconsin, "lead-bearing paint" is defined as any paint or other surface coating material containing more than 0.06 percent lead by weight in liquid paint (concentration of lead by weight). (This is the same as the 1977 CPSC limit of 600 ppm of lead in paint.) Wisconsin also defines "lead-bearing paint" as more than 0.7 milligram of lead per square centimeter in the dried film of applied paint. This standard is used when the investigator measures the lead with an x-ray fluorescence (XRF) instrument (Wis. Stat. 254.11(8)). The results of lead tests measured by XRF are expressed as weight of lead per area tested (often called "loading"). When investigators measure lead per weight of sample, these results are called "concentration," or sometimes "percent."

Air Standards

Environmental standards for lead in the air are set to protect the most susceptible individual in the general population. They are stricter than occupational exposure limits, which are generally set to accommodate healthy people working an eight-hour workday. The EPA regulatory standard for lead in the air is $\leq$1.5 mcg/m^3 averaged over a calendar quarter.

Drinking Water Standards

The EPA is required to set drinking water standards at two levels of protection:

- The maximum contaminant level goals (MCLGs) are determined to be safe for toxicological and biomedical considerations. The EPA has set this level at zero for lead.
- The action level defines when intervention is required to lower the level in drinking water. The action level for lead is when more than 10 percent of tap water samples are $\geq$15 ppb. For further information, call the U.S. EPA Safe Drinking Water Hotline at 1-800-426-4791.

The Wisconsin DNR has adopted the federal action level of 15 ppb for lead, and works with communities to reduce lead in the water through central treatment of their water system. System-wide efforts can be designed to reduce the actual corrosivity of the water, coat the piping with an additive, which acts as a barrier between the pipe and the water, or replace the lead pipes (DNR, 1992).

Plumbing and well components are major contributors to lead in drinking water. The Wisconsin Well Code prohibits the use of lead in any well or pump component. In 1972, Wisconsin banned lead service lines. In 1984, Wisconsin banned lead solder and lead-containing fluxes used in water supply systems. In 1986, the U.S. Congress voted to restrict lead in solder and flux to less

than 0.2 percent lead, to restrict lead in pipes and pipe fittings to less than 8 percent lead, and required states to enforce this law.

Food Standards

Regulating lead contamination in food is the responsibility of the FDA. The FDA has issued the following restrictions on lead content in the various items (see Table 2.1):

Table 2.1. Regulation Limit of Lead in Food Items

Food Type	Regulated Limit
Bottled water	5 ppb
Juice	50 ppb
Candy	100 ppb
Dishware	Varies by type of dishware

According to a 1988 Agency for Toxic Substances and Disease Registry (ATSDR) report, the FDA had estimated that about 20 percent of all dietary lead came from canned food, primarily from lead solder in cans. Following a voluntary decline in use by the U.S. Canned Foods Industry, the FDA banned lead soldered cans in 1995. In 1996, food in lead soldered cans was banned from shelves of U.S. groceries. **Imported canned foods may still contain lead.**

The FDA established guidelines for the amount of lead allowed to leach from ceramic pottery. These levels depend on how frequently the dish is used, the type and temperature of the food it holds, and how long the food is kept in contact with the piece. For example, the most stringent guideline is 0.5 ppm for cups, mugs and pitchers because they are more likely to hold acidic foods such as juice and coffee for longer periods of time. **Ceramics and pottery may still be potential sources of dangerously high levels of lead if imported from a country where lead is not closely regulated.** See FDA website for FDA guidance for lead on ceramic dishes.

Workplace Standards

Maximum allowable levels of lead in the air and blood of people in the workplace, as well as employer responsibilities, are set by OSHA:

- The maximum permissible exposure limit (PEL) of lead in workroom air is at 50 mcg/m^3 averaged over an eight-hour workday.
- For workers exposed to air concentrations $\geq$ 30 mcg/m^3 for more than 30 days per year, OSHA mandates regular blood lead levels (BLLs) be drawn. If a BLL is found to be $\geq$ 40 mcg/dL, the worker must be notified in writing and provided with a medical examination. If a worker's BLL reaches 60 mcg/dL (or averages 50 mcg/dL or more), the employer is obligated to remove the employee from excessive exposure, with maintenance of seniority and pay until the employee's BLL falls below 40 mcg/dL. A copy of the lead standards can be obtained by calling your regional OSHA office or the program manager of the Adult Blood Lead Epidemiology and Surveillance Program in the Bureau of Environmental and Occupational Health (608-264-9829).

Federal Legislation on Lead Hazard Reduction

TITLE X – Residential Lead-Based Paint Hazard Reduction Act

In October 1992, the Residential Lead-Based Paint Hazard Reduction Act (P.L. 102-550), commonly known as Title X, became law. Title X was the most comprehensive and significant federal legislation on lead poisoning in over 20 years. It defined lead-based paint (LBP) hazards and established a framework to evaluate and control LBP hazards. Title X required EPA to set regulatory standards defining lead hazards and reduce the risk of lead exposure from renovation and remodeling projects, required OSHA to issue a lead standard to protect construction workers from lead exposure, tasked HUD to make the federal government act as a model landlord, set standards for federally assisted housing, and promoted lead hazard reduction in private housing through disclosure, public education and expanded federal resources. Some key provisions of Title X are described below.

- **Title X Provisions: Pre-1978 Housing**
  - The federal government is required to act as both a model landlord and model banker. Title X includes a series of requirements covering disposition of federally owned property, as well as inspection, risk assessment, hazard reduction, and abatement activities for federally assisted housing. If families of lead-poisoned children reside in federally owned housing, the landlord to be contacted for lead hazard reduction is the federal government. Similarly, any private housing that receives federal financial assistance must meet certain standards to ensure the safety of occupants.
  - Disclosure of known lead hazards. As a result of Title X, all persons selling or leasing residential housing built before 1978 must:
    - Provide purchasers and renters with a federally approved pamphlet, *Protect Your Family From Lead in Your Home;*
    - Disclose the presence of any available records or knowledge of LBP or LBP hazards to prospective purchasers and renters;
    - Provide purchasers a 10-day opportunity to get a lead hazard inspection;
    - Include certain disclosure and acknowledgment language in sales and leasing contracts; and
    - Requires all agents involved in these transactions to make sure that the seller or landlord complies with the law.

- **Title X Provisions: Worker Training & Public Information**
  - *Lead: Requirements for Lead-Based Paint Activities in Target Housing and Child Occupied Facilities*, EPA, August, 1996. This rule specifies requirements for: (1) accredited training programs; (2) certification/licensing of paint contractors, workers, supervisors, inspectors, and planners working with LBP; and (3) all risk assessments, inspections, and abatement activities in target housing to be performed by certified contractors. Target housing means any dwelling built before 1978 (except those without a bedroom unless inhabited by a child under 6 years of age, and dwellings built for the elderly or persons with disabilities).
  - HUD published "Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing," in 1995 and revised these guidelines in 2012. The guidelines set standards for evaluating and controlling lead hazards in private housing.

- **Title X Provisions: Infrastructure Building**
  - To promote capacity building for sustained lead hazard reduction in a community, agencies that receive housing funds from HUD must follow rules to protect occupants from lead. In 1999, HUD issued a comprehensive lead safe housing rule governing programs that use federal funds for housing purposes. For example, Section 8, Tenant-based Rental Assistance, requires landlords to maintain all coatings in intact condition. Similarly, federally funded housing rehabilitation programs that disturb painted surfaces must meet strict lead dust clearance standards before re-occupancy.
  - State and local governments must develop a Comprehensive Housing Affordability Strategy (CHAS) as a prerequisite before receiving federal housing or community development funds. Title X requires that the CHAS include an estimate of the number of housing units containing LBP hazards that are occupied by low-income families, and that the CHAS outline the actions being taken or proposed to reduce these hazards.
  - In 2008, EPA issued the Renovation, Repair and Painting rule and in 2011, EPA revised the rule. This rule aims to protect the public from lead-based paint hazards associated with renovation, repair and painting activities. These activities can create hazardous lead dust when surfaces with lead paint, even from many decades ago, are disturbed. The rule requires workers to be certified and trained in the use of lead-safe work practices, and requires renovation, repair, and painting firms to be EPA-certified.

    Under this rule, beginning in April 2010, firms performing renovation, repair and painting projects that disturb lead-based paint in homes, child care facilities, and kindergartens built before 1978 must be EPA or state-certified and must use certified renovators who follow specific work practices to prevent lead contamination. This includes in-house maintenance staff and many types of outside contractors. In order to become certified renovators, individuals must take training from an EPA-accredited training provider.

Wisconsin Statutes and Administrative Codes

Department of Health Services

Wisconsin
Department of Health Services

- **Wis. Stat.** Chapter 254: Environmental Health. This statute covers roles, responsibilities and duties in addressing human health hazards in the environment. Sections 254.11 – 254.178 are specific to the diagnosis and treatment of lead poisoning and to the reduction of lead hazards. This statute was amended in 1999 to enhance incentive and protection for owners who wish to identify and treat lead hazards on their properties. Key provisions of this statute include:

  - All blood lead results indicating lead poisoning for any person must be reported to DHS. All blood lead test results of children < 6 years of age are to be reported to DHS. Wis. Stat. 254.13(1).
  - Written reports of all environmental investigations are to be prepared, filed, and made available to the public. Wis. Stat. 254.166(1).
  - Local health departments acting under contract with DHS shall conduct environmental investigations in dwellings with children < 6 years of age who have elevated blood lead

levels (EBLLs), defined as a blood lead level ≥20 mcg/dL by venous sample or 2 venous BLLs ≥15 mcg/dL drawn at least 90 days apart. Wis. Stat. 254.166(1).

- Owners of dwellings where lead hazards have been identified are required to comply with orders to correct lead hazards. Wis. Stat. 254.166(2m).
- Allows local health officers to order the abatement or removal of human health hazards, including lead, whether a resident has an elevated blood lead level or not. The health department may recover the cost of the abatement by placing a special tax on the property to be paid to the municipal treasurer in the community where the hazard was abated via local property tax assessment. Wis. Stat. 254.59(2).
- Counties, cities or towns with health departments may enact ordinances concerning abatement or removal of health hazards. Wis. Stat. 254.59(7).
- Local health departments may declare housing that is dilapidated, unsafe or unsanitary to be a human health hazard. Wis. Stat. 254.593.

- **Wisconsin Administrative Code (Wis. Admin. Code)** DHS 163: Certification for the Identification, Removal and Reduction of Lead-Based Paint Hazards. This rule ensures that activities involving lead-based paint are done safely without creating or increasing lead hazards. The rule provides standards for the training and certification of all doing such work in Wisconsin, and include:

  - The conditions for training and certification required for conducting activities involved in lead hazard identification and reduction. Wis. Admin. Code 163.10-163.12.
  - Work practice standards for the various disciplines and activities of investigation lead hazards, including lead inspections, lead hazard screens, lead risk assessments, lead hazard reduction activities, lead-safe renovation, clearance, and collection and laboratory analysis of samples. Wis. Admin. Code 163.14.

- **Wis. Admin. Code** DHS 181: Reporting of Blood Lead Test Results. This rule ensures the timely reporting to DHS of all tests made to determine the blood lead level of a person. The rule addresses the statutory requirements for reporting of all blood lead tests done on Wisconsin residents, and the establishment of a public health surveillance system. It details the information that must be reported to DHS, the timetable for reporting, and the reporting responsibilities of providers.

- **Wis. Admin. Code** DHS 182: Lead Poisoning or Lead Exposure Prevention Grants. This rule establishes criteria and procedures for DHS to use for annual general purpose revenue project grants to local health departments (LHDs) or non-profits working in collaboration with LHDs on projects to prevent lead poisoning or exposure to lead.

- **Wis. Admin. Code** DHS 157: Radiation Protection. This rule regulates the use and storage of x-ray fluorescence (XRF) devices by certified professionals. The following subchapters of DHS 157 pertain to XRF devices: I, III, X – XIII.

- **Wis. Admin. Code** DHS 134: Facilities Serving People with Developmental Disabilities. This rule requires that in the physical environment, ceilings and walls shall be kept clean and in good repair. The interior and exterior of the buildings shall be painted or stained as needed to protect the surfaces. Loose, cracked or peeling wallpaper or paint shall be replaced or

repaired. A facility shall use lead-free paint inside the facility and shall remove or cover any surfaces containing lead-based paint that are accessible to residents.

Department of Children and Families

- **Wis. Admin. Code** DCF 250: Family Child Care Centers. This rule requires that the physical environment have protective measures to avoid lead exposure while in the child care facility. No recalled products can be available to children. No deteriorated or flaking paint may be present and no lead-based paint may be used on the premises. In addition, under DCF rules, the child care provider must notify their DCF inspector in advance if any renovation of the property is planned.

- **Wis. Admin. Code** DCF 251: Group Child Care Centers. This rule requires that sanitation of the physical environment include protective measures to avoid lead exposure while in the child care facility. No recalled products can be available to children. No deteriorated or flaking paint may be present and no lead-based paint may be used on the premises. In addition, if any renovation of the property is being planned, DCF must be notified in advance because the Wisconsin Lead-Safe Renovation Rule applies to any building built before 1978.

- **Wis. Admin. Code** DCF 252: Day Camps for Children and Day Care Programs Established by School Boards. This rule requires that the base camp and facilities have protective measures to avoid childhood lead exposure. No recalled products can be available to children. No deteriorated or flaking paint may be present and no lead-based paint may be used on the premises. In addition, before any renovation of a pre-1978 dwelling used for child care is conducted, the child care provider must notify their DCF inspector in advance.

- **Wis. Admin. Code** DCF 202: Child Care Certification. This rule requires that small in-home child care premises shall be free of hazards, including recalled products, and not have any chipping or peeling paint on exterior or interior surfaces.

- **Wis. Admin. Code** DCF 56: Foster Home Care for Children. This rule requires that the property on which the foster home is situated, including all other buildings and structures on that property, shall be maintained in a state of good repair and in a sanitary condition so that it is safe for the occupants and their health is safeguarded.

Department of Agriculture, Trade and Consumer Protection

Wisconsin Department of Agriculture, Trade & Consumer Protection datcp.wisconsin.gov

- **Wis. Stat.** Chapter 704: Landlord and Tenant. Describes the conditions under which a tenant may move without incurring liability due to untenantability, including conditions that are hazardous to health.

- **Wis. Stat.** Chapter 709: Disclosures by Owners of Residential Real Estate. In addition to the Federal Disclosure requirements, this act specifies the disclosure of lead in real estate for sale in Wisconsin.

- **Wis. Admin. Code** ATCP 134: Residential Rental Practices. This rule outlines the requirements for a property owner to disclose any condition of the dwelling that constitutes a health hazard.

- **Wis. Stat.** Chapter 704: Landlord and Tenant. Describes the conditions under which a tenant may move without incurring liability due to untenantability, including conditions that are hazardous to health.

Department of Natural Resources

WISCONSIN DNR Department of Natural Resources

- **Wis. Stat.** Chapter 809: Safe Drinking Water. Describes general requirements for the control of lead in drinking water, such as monitoring and analysis, lead service line replacement and public education.

Chapter 3

Toxicology, Societal Costs of Lead Exposure, Sources and Routes of Lead Exposure

Contents

Introduction 3.2

Lead Exposure in Human History 3.2

Lead in the Human Body 3.2

- Exposure and Absorption of Lead in Children's Bodies 3.2
- Distribution of Lead in Children's Bodies 3.3
- Elimination of Lead from Children's Bodies 3.4
- Adverse Effects of Lead Exposure 3.4

Societal Costs of Lead Exposure In Children 3.6

Sources and Routes of Lead Exposure 3.7

References 3.12

Introduction

There are multiple sources of lead in the environment that threaten the developing minds and capacities of young children. The effects of lead depend on both the level and the duration of exposure. Children may be more vulnerable to lead exposure at certain ages. The primary source of exposure for adults is in the workplace. For children, the primary exposure is from dust formed from deteriorated lead-based paint (LBP) or varnish. The lead dust makes its way into the body through normal hand-to-mouth activities of very young children.

This chapter provides information on the history of lead as a toxin, how the body metabolizes lead, the adverse effects of lead on young children, societal costs of lead exposure and the most common sources and routes of lead exposure.

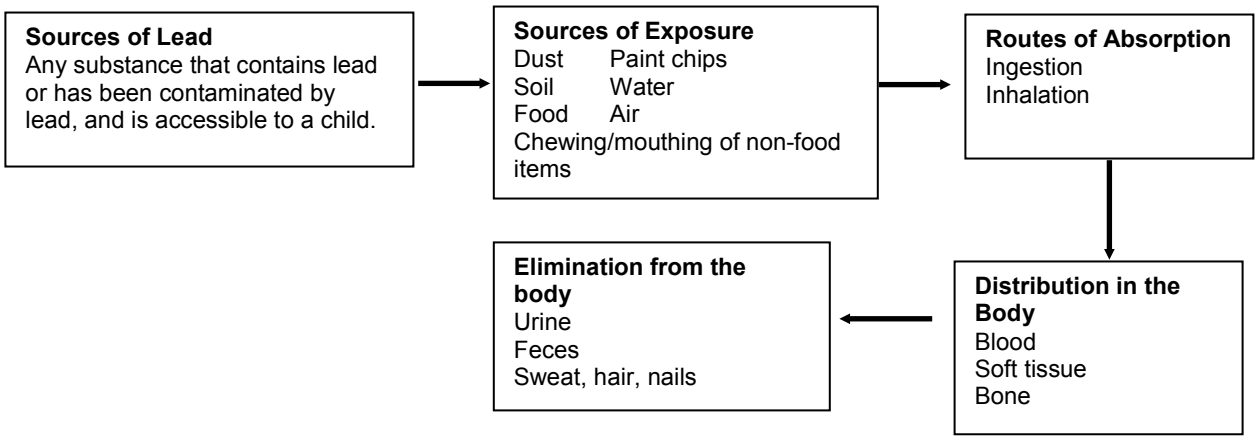
Lead Exposure in Human History

Lead is ubiquitous in modern industrialized societies, and evidence of the negative effects of lead on humans has been noted for centuries. Historical researchers have taken an in-depth look at the history of the uses of lead, its toxicity, and the role of the lead paint industry in the research and promotion of lead (Markowitz and Rosner 2002, 2013).

Lead in the Human Body

Just as the sources of lead exposure in children differ from adults, so does the way a child's body metabolizes and is affected by lead. Figure 3.1 shows the path lead takes in a child's body from exposure (usually through hand-to-mouth activity) to elimination. A more detailed discussion of the most common sources of lead and routes of exposure are discussed in the last section of this chapter.

Figure 3.1
Lead Sources and Routes of Exposure



Exposure and Absorption of Lead in Children's Bodies

The primary route of exposure to lead in children is through the gastrointestinal tract. Ingestion of lead contaminated dust through normal hand-to-mouth activity is the primary manner in which children introduce lead into their bodies. Children's blood lead levels peak around 15 to 24 months of age coinciding with increased hand-to-mouth behavior and increased mobility in

children at these ages. Children's blood lead levels also tend to be higher in the summer months. This seasonal trend reflects the fact that (a) children play outdoors more in summer and thus have more contact with exterior paint in summer time and (b) dwelling exteriors typically have more lead paint than interior surfaces. Exposure to exterior leaded paint may come from a variety of activities. Children may play on lead-painted porches and stairs or next to exterior walls, or play in yards or alleys where deteriorated paint has fallen to the ground. In climates such as Wisconsin, windows are opened in the summer months, allowing deteriorated exterior paint on windows or walls to enter the home environment and become accessible.

Children absorb up to 50 percent of the lead they ingest, about five times as much as adults. Gastrointestinal absorption of lead is enhanced by a fasting state, iron or calcium deficiency, and high fat diets.

Children who play outdoors near lead contaminated soil are at risk of exposure if they contaminate their hands and then either put their hands in their mouth or eat without washing their hands. Studies of lead in soil find that smaller particles of soil contain a higher percentage of lead. This trend is true especially as particle size decreases below the visible range. (Clark et al, 2006)

Children who ingest lead particles absorb more lead from smaller particle sizes. These ingested particles may come from paint or from historical leaded gasoline emissions.

Lead is absorbed rapidly through the lungs when inhaled. Smaller particles are more efficiently absorbed. Up to 95 percent of inhaled lead is absorbed, if particle size is less than 1 micron. The primary source of inhaled lead had been emissions of small particles of lead oxide from automobiles using leaded gasoline. Since the phase-out of lead from gasoline, the amount of lead inhaled by children is typically far smaller than the amount ingested.

Absorption of inorganic lead through the skin is minimal. By contrast, organic lead compounds such as leaded gasoline are easily skin absorbed. Lead poisoning in children through dermal exposure is rare, primarily because leaded gasoline has been mostly phased out and children's contact with these materials is limited.

Distribution of Lead in Children's Bodies

Once absorbed into the child's system, lead is distributed in three body systems: blood, soft tissue, and bone. The concentration and mobility of lead within each system varies (see Table 3.1).

The blood lead level (BLL) is the most common measurement of lead exposure, although it represents only 5 to 10 percent of the total body lead burden. Once in the blood, up to 99 percent of lead may be bound to erythrocytes and cannot diffuse across cell membranes. Approximately 1-10 percent is bound to microligands in the plasma. It is this pool that is capable of crossing cell membranes and therefore can become biologically active. Because lead is found primarily in the red blood cell rather than plasma, there are implications when collecting capillary blood lead samples. If the finger is squeezed too hard, a blood sample may be obtained that is higher in plasma, resulting in a BLL that is falsely low. Lead readily binds to fetal hemoglobin. (For more information, see Chapter 8: Medical Management.)

Table 3.1 Distribution of Lead in the Body

	Blood	Soft Tissue	Bone
Half-life	30 days	40 days	Spongy (pelvis, ribs, skull): 3-5 years Cortical (midtibia, midfemur): 30 years
% Total body burden	up to 10%	10-20%	70% in children 90% in adults

Source: Lead Poisoning in Childhood, S. Pueschel, J. Linakis, A. Anderson

Up to 20 percent of lead retained in the body is stored in soft tissues such as kidney, liver, bone marrow, and brain. It is in these sites where lead has the most toxic effects. The extent of damage to soft tissues is related directly to the amount and duration of exposure; higher exposures and persistent exposures cause more severe effects.

The remainder of lead retained by the body is stored in the bones. The half-life of lead in bone can be up to 30 years, and throughout that time it seeks to create a steady-state with blood lead. As the BLL drops due to chelation and/or decreased exposure, lead migrates from the bone to blood, and may be the cause of a prolonged elevated blood lead level. Bone-to-blood migration may also occur during pregnancy and lactation in women with high bone lead levels, which may have developed in early childhood or following fractures (see Chapter 11 Reproductive).

Elimination of Lead from Children's Bodies

An estimated 60 percent of absorbed lead is eliminated from the body. The primary route of elimination is through the kidney, followed by feces, hair and nail growth, and sweat loss. In animal studies comparing lead metabolism in infant and adult rats, lead was cleared from the blood much more slowly in infant rats, and localized in the brain to a greater degree.

Adverse Effects of Lead Exposure

The CDC identifies lead as the number one environmental health threat to young children. Lead toxicity can have an adverse effect on virtually every system in the body. The result of lead toxicity can be seen in the peripheral nervous, hematopoietic, renal, and gastrointestinal systems. It affects the regulation of vitamin D, and the growth, hearing, and cognitive development of a young child. Most importantly, it can cause irreversible damage to the central nervous system. At very high levels, lead exposure can cause seizures, coma, and death.

Continued research on lead toxicity in children has caused a rapid decrease in the blood lead levels of concern for children. As recently as the early 1960s, the level of concern for children was 60 mcg/dL. In 1985, that level was lowered to 25 mcg/dL; in 1991, the level was lowered to 10 mcg/dL. That decrease was prompted by an acceptance of widespread research that showed damage from lead at BLLs as low as 10 mcg/dL to the central nervous system of young children, causing developmental delays, lower IQ, hyperactivity, learning disabilities, behavioral problems, and school failure. Physical effects noted at this level include impaired hearing, slowed growth, and nephropathy. In May 2012, CDC concurred with its advisory committee's recommendation to acknowledge negative health effects in young children with BLLs as low as 5 mcg/dL and to change the terminology from "level of concern" to "reference level." The recommendation was made due to the overwhelming evidence that lead exposure at levels below 10 mcg/dL causes damage to the cognitive, cardiovascular, endocrine, and immune systems.

The recommendation of the ACCLPP arises from several considerations. In the first research that specifically looked at a large number of children with BLLs known to be <10 mcg/dL, deficits in cognition and academic abilities associated with lead exposure have been noted. Adjusting for factors known to have an impact on these outcomes, children with BLLs ≥3 mcg/dL demonstrated impairment in cognitive, memory and visual-spatial skills. The adverse effects of lead on reading and other language-based abilities were significant, as these are potent predictors of academic achievement and anti-social behavior. This study further supports the research that has indicated no minimal threshold for lead toxicity.

In 2003, Canfield et al. reported decrements in school age IQ among 213 children whose peak BLLs had never exceeded 10 mcg/dL. Similarly, Bellinger and Needleman (2003), in a re-analysis of data from 48 children from the Boston cohort study whose BLLs never exceeded 10 mcg/dL, reported a similar association. Since 2003, additional reports of associations between BLLs <10 mcg/dL in children with adverse cognitive, and increasingly with other physiological consequences, have been published. Additionally, data from earlier cross-sectional studies of IQ in older children, not considered central to the argument in 2003, have since been re-interpreted as highly relevant, based on re-analysis of prospective data focusing specifically on the time course of associations between blood lead and IQ.

ACCLPP reviewed these and other data, and stated in 2005 that these associations, more likely than not, were causal. There are now additional compelling studies in the scientific literature reporting associations between BLLs <10 mcg/dL and adverse effects in children that form a more substantive body of evidence than was available at the time of the 2005 CDC statement. Collectively, these new studies, and re-interpretation of past studies, have demonstrated that it is not possible to determine a threshold below which BLL is not inversely related to IQ. Healey et al., citing Lanphear et al. as the critical study in its toxicological assessment, asserted that there is a negative slope relating BLL and IQ down to concurrent BLLs of 1 mcg/dL. An increase in concurrent BLL from 1 to 4 mcg/dL is associated with a change in mean IQ of approximately -2.3 to -5.2 IQ points, with a best estimate of -3.7 IQ points. The German Human Biomonitoring Commission concluded that it is not possible to identify a threshold BLL below which there are no cognitive deficits.

Studies have also now extended the effects of low BLLs, and suggest the involvement of specific areas of cognitive dysfunction. These include measures of academic achievement such as reading and writing, as well as attention deficits, specifically impulsivity. For example, Chandramouli et al. reported that BLLs in the range of 5-10 mcg/dL in 30-month-old children were associated with reductions in reading and writing scores in 7- to 8-year-old children from the Avon Longitudinal Study. In a case-control study of children 6 to17 years old, where the mean BLL was 0.73 and maximum BLL was 2.2 mcg/dL, higher BLLs were associated with parent-reported combined-type attention deficit hyperactivity disorder and hyperactivity-impulsivity after controlling for IQ and prenatal smoking.

Lead and Learning

Two recent UW-Madison studies (Amato et al., 2012, 2013) of Milwaukee 4th grade students found that those who were lead poisoned before the age of 3 were almost 3 times more likely to:

- **be suspended from school**
- **fail 4th grade**

School suspensions are associated with lower reading achievement, tobacco use, dropping out of school and violent behavior later in life.

The effects reported in children are supported by biological plausibility, i.e., experimental animal studies. Animal research on the effects of lead on brain structure and function demonstrate multiple cellular and synaptic disruptions caused by lead. These disruptions in cellular anatomy and neurotransmitter systems can be noted by the breakdown in their function of modulating emotional response, memory, learning and visual-spatial relationships. Studies have persistently shown a correlation between low-level lead exposure during early brain development and deficits in neurobehavioral-cognitive performance that manifest later in childhood. The effects demonstrated in several longitudinal studies have been consistent across cultures, racial/ethnic groups, and social/economic class.

Prenatal lead exposure has been associated with increased risk of pre-term delivery, reduced birth weight, and reduced performance on neurological testing. For children whose subsequent lead exposure is low and who receive developmentally appropriate stimulation, there is evidence that the damaging neurological effects associated with prenatal exposure may be partially ameliorated by environmental enrichment (see Chapter 10. Educational Assessment and Intervention).

Lead poisoning continues to predict negative outcomes for adults poisoned as children. Violent crimes committed by adults are strongly associated with prenatal and childhood lead poisoning; a 2008 study found that for each increase of 5 micrograms per deciliter of lead in blood as a child, an individual's risk of being arrested for a crime as an adult increases by 50 percent.

Lead in the body can negatively impact health throughout the lifespan. Childhood lead poisoning increases the risk of death from stroke and heart attack as adults. Studies have also shown that childhood lead exposure is linked to adult kidney disease, diabetes, depression, panic attacks and cognitive deficits such as memory loss and Alzheimer's disease.

Societal Costs of Lead Exposure In Children

Societal costs of lead exposure include increased incidence of poor school performance, behavior disorders, and anti-social behavior among children who are lead poisoned. Difficulties achieving in school can lead to classroom disruption, increased costs for special education, and decreased earning potential for the affected child.

Many studies have documented that there is no safe level of lead in the body. Blood lead levels as low as 5 mcg/dL are linked to decreased school performance, behavioral problems, and other difficulties in learning.

In addition, Wright et al. found that lead-exposed children are more likely to be arrested for violent crimes as young adults. A prospective study that followed 250 children from before birth to early adulthood found that each increase in 5 mcg/dL of lead in blood observed at age 6 increased the probability of an arrest for violent crime as a young adult by 48 percent when controlling for other potentially confounding factors (Wright et al., 2008).

These damaging effects of lead poisoning result in heavy costs for the families of lead poisoned children and for the communities where children live. In 2011, Trasande and Liu calculated the annual cost of lead poisoning in the U.S. to be 76.6 billion. Wisconsin's proportional share of these costs is $1.5 billion per year; note that this estimate excludes the costs of crime associated with lead exposure. Estimates that include the savings from crime prevention (such as Muennin and Bao) are higher, approximately $4 billion/year. In 2009, Gould calculated that each dollar spent on preventing lead poisoning results in a return on investment of $17 to $221 when the costs of lead poisoning, which include health care, education, lost earnings and crime, are calculated.

Lead Poisoning Costs Families and Society

- Each year Wisconsin spends over $5 billion on school aids including $375 million for special education and $1 billion for corrections. Some percentage of these costs is attributable to lead poisoning.
- For each group of Wisconsin children age 0-6 today protected from any lead exposure, the improvement in the state high school graduation rate and the reduction in crime across the state would save Wisconsin $28 billion, thus saving $4 billion per year (Muennin and Bao 2009)

Sources and Routes of Lead Exposure

The following pages include brief descriptions of the commonly identified sources of lead exposure and the vehicles or routes by which they enter a child's body. It is important to remember that LBP and varnish are the primary sources of lead poisoning among children in Wisconsin and nationwide.

1. Source: LBP and varnish

Exposure to lead-based paint (LBP) is the major source of lead poisoning for children. When lead paint is intact, it is unlikely to cause exposure. The risk of exposure increases as the paint breaks down into smaller particles. The smaller the particles, the more easily they are dispersed, become accessible to children, and are absorbed by the body. If lead paint is allowed to deteriorate due to normal wear (moisture damage, temperature changes, friction, or impact), or when paint is deliberately disturbed by renovation activity, house dust and soil become contaminated. The resulting lead dust and chips can enter a child's body through normal hand-to-mouth activity.

Routes of Exposure:

- Lead dust created by deteriorating LBP or renovation activities can stick to fingers, toys, soil, food, and other accessible surfaces. Young children are then likely to ingest the lead dust through normal hand-to-mouth activity. This is the most common route of exposure for children.
- LBP is a hazard if it is peeling, chipping, chalking, or cracking. LBP that appears to be undisturbed can be a problem if it is on surfaces that rub together (friction surfaces) or surfaces that children chew, such as windows and window sills, doors and door frames, stairs, railings and banisters, porches, fences, and/or furniture.
- Surfaces that have been covered with new paint or another covering can expose layers of LBP if they are consistently rubbed, or when they become cracked, chipped or deteriorated.
- Lead in varnish is typically found on floors, stairs, doors, windows and wood trim and even old baby cribs.

- LBP that is intact, undisturbed, and inaccessible to young children may not pose a lead hazard and should be left alone.

2. Source: Industrial Source/Occupational

Industries that produce and/or use lead in manufacturing can create lead hazards. A list of industries identified with EBLLs among workers is listed in Table 3.2. Construction trade activity that disturbs old paint can cause exposure to LBP dust for workers through ingestion and inhalation; their families, from exposure to contaminated clothing and shoes; and dwelling occupants, from lead particles created by the work and left in the dwelling.

Table 3.2. Industries Linked to Elevated Blood Lead Levels

Industry	Products Used in Industry
Secondary smelting/refining of nonferrous metals Brass foundry Plumbing fixture fittings and trim (brass goods)	Storage batteries (lead batteries) Valve and pipe fittings (except plumber's brass goods) Glass products made with lead Primary batteries, dry and wet
Motor vehicle parts/accessories Firing ranges Pottery studios Bridge, tunnel, and elevated highway construction Automotive repair shops	Chemicals and chemical preparations Industrial machinery and equipment Inorganic pigments

Source: Bader and Marion, 1990; Maizlish et al., 1990.

Routes of Exposure:

- Lead-emitting industries such as smelters and battery manufacturing plants can cause lead contamination of air, soil, and food grown in contaminated soil.
- Adults working in industries or other occupations involving exposure to lead may be directly exposed and/or may carry lead-contaminated dust home to their families on their hair, clothing, and shoes.

3. Source: Hobbies

Hobbies that involve lead or lead-containing materials (Table 3.3) can cause exposure if steps are not taken to contain the lead and keep it away from children.

Table 3.3. Hobbies Involving Lead Products

Hobby	Products Used in Hobby
Casting	Ammunition, fishing weights, toy soldiers
Stained glass	Lead solder
Making pottery	Lead glazes
Furniture refinishing	Leaded paint or varnish
Art and painting	Paints, glazes or colored pencils

Source: Adapted from CDC Manual, 1991

Routes of Exposure:

- Eating, drinking, or smoking in the work area.
- Hands or clothes worn while working can become contaminated and expose children through contact. People involved in these hobbies are advised to avoid contact with children until they have showered and changed clothes.
- Lead contaminated dust from these hobbies can be spread to other areas of the home where children play or spend time.

4. Source: Toys, Children's Products and Other Household Products

In 1978, regulation of the commercial manufacturing of toys and children's products in the United States became more stringent for lead content. However, lead is periodically identified in products made in the United States or imported. There is concern about the lead content of toys imported from Southeast Asia, Central and South America, Eastern European countries, and Mexico.

Examples of widely used products that have been found to contain lead are candles with leaded wicks, vinyl mini and vertical blinds, and car keys. Any products built before 1978, such as toys, playground equipment and furniture, should be regarded as containing lead until tested.

Imported candies from Mexico, Thailand, and China have been tested and found to contain high levels of lead. The California Department of Health website includes a current list of candies tested for lead and a file with pictures of candies that have tested positive for lead.

For current information on other product recalls, contact CPSC directly at 800-638-2772 or visit a website where you can search a database for products that contain lead. EPA's website also includes information on lead in products.

Routes of Exposure:
Mouthing, chewing, or ingesting dust or paint from products that contain lead.

5. Source: Traditional Home Remedies, Imported Candies and Cosmetics

In some cultures, families may use remedies or cosmetics that contain lead (see Table 3.4). Use of powder remedies containing lead for cosmetics or medical conditions is often

steeped in traditions that may be unfamiliar to health care professionals in the U.S. It may take several interactions with the family to gain their trust and willingness to inform you of how, why, and which of these medicines or cosmetics they may use. In addition, use of herbal supplements has been linked to increased lead in blood among women. (Buettner C. et al., 2006) If possible, obtain a sample of the suspected medicine or cosmetic to be analyzed for lead at the Wisconsin State Laboratory of Hygiene.

Table 3.4. Traditional Home Remedies/Cosmetics Containing Lead

Culture/use of product	Name(s) of product	Description of product
Latino: abdominal pain called "empacho"	Alarcon, azarcon, coral, greta, liga, rueda	Yellow or orange powders
Asian, Indian: intestinal disorders	Ghasard Bali goli Kandu	Brown powder Flat black bean Red powder
Hmong: fever or rash	Pay-loo-ah	Red powder
Asia and Mideastern countries: cosmetic, treatment for infections of the skin or umbilical stump, for ceremonial use or eye protection	Kohl or akohl Surma Ceruse Kajal	Powder

Route of Exposure:
Direct ingestion, if taken as a medication, or hand-to-mouth, if topical application is involved, such as with a cosmetic.

6. Source: Plumbing fixtures and pipes that contain lead

The most common source of contamination of drinking water is lead in plumbing solder. Contamination from lead pipes, lead connectors, and lead service lines is less frequent. Brass or bronze plumbing and well parts that have lead added to increase the malleability may be disguised by a chrome coating. The small wire mesh screen at the spigot end of the faucet can trap lead solder particles and contaminate the water. Where lead is present in plumbing, contamination is increased by corrosive water (acidic or low mineral content, "soft" water), the length of time the water sits in the pipes, and hot water.

Routes of Exposure:
Water that passes through lead containing plumbing fixtures or pipes can become contaminated and become a hazard when used in drinking, cooking, or food and formula preparation.

7. Source: Dishware

The lead content of commercial dishware, pottery and crystal manufactured in the U.S. is regulated. However, if these items are imported from countries without such regulation they may contain dangerous amounts of lead in glaze or glass. On occasion, the Consumer Product Safety Commission (CPSC) has recalled products that contain unsafe amounts of lead, such as imported ceramics and dishware.

If you would like more information on product recalls, contact CPSC directly at 800-638-2772 or visit their web site, http://www.cpsc.gov. The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) also conducts product recalls and notices on unsafe products. You can contact DATCP at 608-224-4944 or visit http://datcp.wi.gov/Consumer/Product_Safety/Children_Recalls_and_Advice/index.aspx.

Routes of Exposure:

- Ingestion of contaminated foods stored in dishes with leaded glaze or paint or leaded crystal.
- Acidic foods and beverages, such as tomato sauce, coffee, juice or wine can exacerbate the leaching of lead when prepared or stored in leaded containers.

8. Source: Lead-Based Solder in Cans

The lead solder used to seal cans may contaminate the food it contains. In 1995, the U.S. banned the use of lead solder in food or soft drink cans, but it is still used in many other countries and may still be found in cans imported to the U.S.

Routes of Exposure:

Ingestion by children of food or beverages stored in cans with lead-soldering.

9. Source: Leaded Gasoline

Leaded gasoline contributes directly to air lead levels. Fallout from the air causes contamination of soil, dust, and crops. Lead in soil does not biodegrade. Annual emissions of lead from gasoline have fallen dramatically since the mid-1970s, when the lead content of gasoline was regulated. The decline of lead in gasoline has been accompanied by a decline in the mean BLLs of the United States (U.S.) population. However, leaded gasoline is still used in some airplanes and is available for racing cars in the U.S. Leaded gasoline is still used in other countries, and children who are adopted or immigrate from these countries should be tested for lead poisoning.

Routes of Exposure:

- Exhaust from leaded gasoline stays in several inches of topsoil.
- Children playing on or in the soil may be exposed.
- Food grown in contaminated soil may contain lead.

References

Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention (2012), Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, *U.S. Department of Health and Human Services*.

American Academy of Pediatrics, Committee on Environmental Health (1993), *Lead Poisoning: From Screening to Primary Prevention, U.S. Department of Health and Human Services*.

Agency for Toxic Substances and Disease Registry (2010), Case Studies in Environmental Medicine, Lead Toxicity, *U.S. Department of Health and Human Services*.

ATSDR (2007), Toxicological Profile for Lead, *U.S. Department of Health and Human Services*.

Bellinger, D. C., Needleman, H. L. (2003), Intellectual impairment and blood lead levels. *New England Journal of Medicine,* 2003; 349(5):500-2.

Buettner, C., Mukamal, K., J., Gardiner, P., Davis, R. B., Phillips, R., S., Mittleman, M., A. (2006), Herbal Supplement Use and Blood Lead Levels of United States Adults, *Journal of General Internal Medicine*. 24 (11):1175-1182.

Clark, H. F., Brabander, D. J., Erdill, R. M. (2006), Sources, Sinks, and Exposure Pathways of Lead in Urban Garden Soil, *Journal of Environmental Quality,* 35:2066-2074.

Dietrich, K. M., Berger, O., Succop, P., Hammond, P., Bornshein, R. (1993), The Developmental Consequences of Low to Moderate Prenatal and Postnatal Lead Exposure: Intellectual Attainment in the Cincinnati Lead Study Cohort Following School Entry, *Neurotoxicological Teratology*, 15:37-44.

Finkelstein, Y., Markowitz, M., Rosen, J. (1998), Low Level Lead Induced Neurotoxicity in Children: An Update on Central Nervous System Effects, *Brain Research Reviews*, 27:168-176.

Geller, A. M. (2009), Making the Needed Linkages and Economic Case for Continued Lead Paint Abatement, *Environmental Health Perspectives* 117(8):A332-A334.

Gould, E. (2009), Childhood Lead Poisoning: Conservative Estimates of the Social and Economic Benefits of Lead Hazard Control, *Environmental Health Perspectives*, 117(7):1162-7.

Hornung, R. W., Lanphear, B. P., Dietrich, K. M. (2009), Age of Greatest Susceptibility to Childhood Lead Exposure: A New Statistical Approach, *Environmental Health Perspectives,* 117(8):1309-12.

Jacobs, D. (1996), The Health Effects of Lead on the Human Body, *Lead Perspectives,*10-12.

Jones, T. F., Moore, W. L., Craig, A. S., Reasons, R. L., Schaffner, W. (1999), Hidden Threats: Lead Poisoning From Unusual Sources, *Pediatrics,* 104(5):1223-1225.

Kuhlman, A. C., McGlothan, J. L., Guilarte, T.R. (1997), Developmental Lead Exposure Causes Spatial Learning Deficits in Adult Rats, *Neuroscience Letters*, 233(2-3):101-104

Lanphear, B. P., Dietrich, K. M., Auinger, P., Cox, C. (2000), Cognitive Deficits Associated with Blood Lead Concentrations <10μg/dL in U.S. Children and Adolescents, *Public Health Reports,* November/December.

Markowitz, G., Rosner, D. (2002), Deceit and Denial, the deadly politics of industrial pollution, University of California Press.

McMichael, A.H., Baghurst, P., Vimpani, G., Wigg, N., Robertson, E., Tong, S. (1994), Tooth Lead Levels and IQ in School-Age Children: The Port Pirie Cohort Study," *American Journal of Epidemiology*, 140(6), 489-499.

Mendelsohn, A., Dreyer, B. P., Fierman, A. H., Rosen, C., M., Legano, L. A., Kruger, H. A., Lim, S. W., Courtland C. D. (1998), Low Level Lead Exposure & Behavior in Early Childhood, *Pediatrics*, 101(3).

Muennin, P, Bao, P. (2009), The social costs of childhood lead exposure in New Jersey, New Jersey Department of the Public Advocate.

National Academy of Sciences (1993), Measuring Lead Exposure in Infants, Children and Other Sensitive Populations, Washington, D.C., *National Academy Press.*

Needleman, H. L., et al (1996), Bone Lead Levels and Delinquent Behavior, *Journal of the American Medical Association*, 275(5), 363-369.

Nevin, R. (2000), How Lead Exposure Relates to Temporal Changes in IQ, Violent Crime, and Unwed Pregnancy, *Environmental Research,* 83(1), 1-22.

Nevin R., Jacobs, D. E., Berg, M., Cohen, J. (2008), Monetary Benefits of Preventing Lead Poisoning With Lead-Safe Window Replacement. *Environmental Research* 106(3):410-419.

Pueschel, S. M., Linakis, J. G., Anderson, A. C. (1996), Lead Poisoning in Childhood, *Paul H. Brooks Publishing.*

Schirmer, J., Havlena, J., Jacobs, D. E., Dixon, S., Ikens, R. (2012), Lead Exposures from Varnished Floor Refinishing, *Journal of Occupational and Environmental Hygiene,* 9: 280-287.

Schwartz, Joel (1994), "Low Level Lead Exposure and Children's IQ: A Meta Analysis and Search for a Threshold," *Environmental Research*, 65:420-55.

Tong, S., Baghurst, P., McMichael, A., Sawyer, M., Mudge., J. (1996), Lifetime Exposure to Environmental Lead and Children's Intelligence at 11-13 years: The Port Pirie Cohort Study, *British Medical Journal*, 312(7046):1569-70.

Tong, S., Baghurst, P., Sawyer, M., Burns, J., McMichael, M. (1998), Declining Blood Lead Levels and Changes in Cognitive Function During Childhood, *JAMA*, 280(22):1915-1919.

Tong, S. (1998), "Lead Exposure and Cognitive Development: Persistence and a Dynamic Pattern, *Journal of Paediatric Child Health*, 34(2):114-118.

Trasande, L., Liu, Y. (2011), Reducing the Staggering Costs of Environmental Disease In Children, Estimated At $76.6 Billion in 2008, *Health Affairs* 30(5):863-870.

United States Environmental Protection Agency, Prevention, Pesticides, and Toxic Substances (7404) (1998), Lead In Your Home: A Parent's Reference Guide.

U.S. Department of Health and Human Services, National Toxicology Program (2012), NTP Monograph: Health Effects of Low-Level Lead.

Wisconsin Council on Children and Families (1999), *Great Beginnings: The First Years Last Forever.*

Wright J. P., Dietrich K. M., Ris, D. M., Hornung, R. W., Wessel, S. D., Lanphear, B. P., Ho, M., Rae, M. N. (2008), Association of Prenatal and Childhood Blood Lead Concentrations with Criminal Arrests in Early Adulthood. *Plos Medicine* 5:0732-0740.

Chapter 4

Primary Prevention and Educating for Behavior Change

Contents

Introduction 4.2
Individual Level Primary Prevention Activities 4.2
Community Level Primary Prevention Activities 4.4
Housing-based Strategies 4.5
Educating for Behavior Change 4.10
Planning for Evaluation 4.13
An Example of a Targeted Education Strategy 4.16
References 4.17

Introduction

The purpose of primary prevention is to prevent disease before it occurs. Primary prevention of childhood lead poisoning focuses on children at risk and the environment(s) in which they live. In January 2012, the Centers for Disease Control and Prevention's (CDC) Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP, 2012) stated that the recommended approach to prevent lead poisoning is to reduce exposures to lead-based paint hazards and to make and keep the U.S. housing stock "lead-safe."

The ACCLPP made specific recommendations with respect to primary prevention:

- Educate families, service providers, advocates and public officials on primary prevention of lead exposure in homes and other child-occupied facilities so that lead hazards are eliminated before children are exposed.
- CDC should encourage local, state, and other federal agencies to:
  - ✓ Facilitate data-sharing between health and housing agencies;
  - ✓ Develop and enforce preventive lead-safe housing standards for rental and owner-occupied housing;
  - ✓ Identify financing for lead hazard remediation; and
  - ✓ Provide families with the information needed to protect their children from hazards in the home.

The responsibility to recognize and address lead hazards extends beyond public health and medical professionals to all community members such as property owners, housing agencies, parents, construction trades, child advocacy groups, and neighborhood organizations.

Primary prevention includes activities at *both the individual and the community level.* At the individual level, public health activities focus on providing or assuring access to safe housing, good health care, nutrition and education for children and their families for effective prevention of lead poisoning. Within the community, the public health focus is on assessing and assuring that the community is alert and mobilized to address the lead hazards that threaten the children in their community.

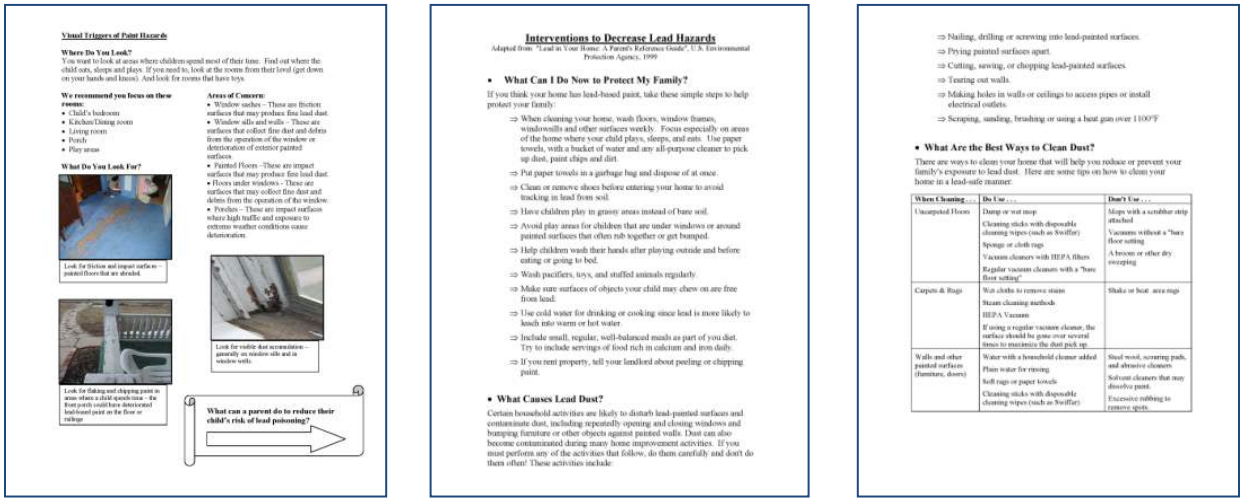
Individual Level Primary Prevention Activities

To prevent childhood lead poisoning, parents of young children need to be informed about the dangers of lead and how to identify and control lead hazards, and be provided with the tools needed to protect their children from lead exposure.

Anticipatory Guidance for Families

During prenatal visits and pediatric preventive care visits (under age 6), health care providers should provide information to families about the hazards of deteriorating lead-based paint in older housing, the hazards associated with repainting and renovation of homes built prior to 1978, and other exposure sources that may be particular to a family (such as occupational exposure or traditional remedies). It is important that this information be presented to parents/caregivers at multiple and specific times during their child's development. The risk of exposure increases as the child becomes mobile (crawling and walking) in his/her environment and engages in hand-to-mouth behavior.

An effective visual tool for sharing brief, but important, information about potential lead hazards that people can immediately recognize is the *Visual Triggers of Paint Hazards* (see Figure 4.1; see Appendix B for this tool). This is a useful instructional tool during home visits as well.



Visual Triggers of Paint Hazards

Where Do You Look?
You want to look at areas where children spend most of their time. Find out where the child eats, sleeps and plays. If you need to, look at the rooms from their level (get down on your hands and knees). And look for rooms that have toys.

We recommend you focus on these rooms:
- Child's bedroom
- Kitchen/Dining room
- Living room
- Porch
- Play areas

Areas of Concern:
- Window sashes – These are friction surfaces that may produce fine lead dust.
- Window sills and wells – These are surfaces that collect fine dust and debris from the operation of the window or deterioration of exterior painted surfaces.
- Painted Floors –These are impact surfaces that may produce fine lead dust.
- Floors under windows - These are surfaces that may collect fine dust and debris from the operation of the window.
- Porches – These are impact surfaces where high traffic and exposure to extreme weather conditions cause deterioration.

What Do You Look For?

Look for friction and impact surfaces – painted floors that are abraded.

Look for visible dust accumulation – generally on window sills and in window wells.

Look for flaking and chipping paint in areas where a child spends time – for front porch could have deteriorated lead-based paint on the floor or railings

What can a parent do to reduce their child's risk of lead poisoning?

Interventions to Decrease Lead Hazards
Adapted from "Lead in Your Home: A Parent's Reference Guide", U. S. Environmental Protection Agency, 1999

- **What Can I Do Now to Protect My Family?**

If you think your home has lead-based paint, take these simple steps to help protect your family:

⇒ When cleaning your home, wash floors, window frames, windowsills and other surfaces weekly. Focus especially on areas of the home where your child plays, sleeps, and eats. Use paper towels, with a bucket of water and any all-purpose cleaner to pick up dust, paint chips and dirt.

⇒ Put paper towels in a garbage bag and dispose of at once.

⇒ Clean or remove shoes before entering your home to avoid tracking in lead from soil.

⇒ Have children play in grassy areas instead of bare soil.

⇒ Avoid play areas for children that are under windows or around painted surfaces that often rub together or get bumped.

⇒ Help children wash their hands after playing outside and before eating or going to bed.

⇒ Wash pacifiers, toys, and stuffed animals regularly.

⇒ Make sure surfaces of objects your child may chew on are free from lead.

⇒ Use cold water for drinking or cooking since lead is more likely to leach into warm or hot water.

⇒ Include small, regular, well-balanced meals as part of you diet. Try to include servings of food rich in calcium and iron daily.

⇒ If you rent property, tell your landlord about peeling or chipping paint.

- **What Causes Lead Dust?**

Certain household activities are likely to disturb lead-painted surfaces and contaminate dust, including repeatedly opening and closing windows and bumping furniture or other objects against painted walls. Dust can also become contaminated during many home improvement activities. If you must perform any of the activities that follow, do them carefully and don't do them often! These activities include:

⇒ Nailing, drilling or screwing into lead-painted surfaces.

⇒ Prying painted surfaces apart.

⇒ Cutting, sawing, or chopping lead-painted surfaces.

⇒ Tearing out walls.

⇒ Making holes in walls or ceilings to access pipes or install electrical outlets.

⇒ Scraping, sanding, brushing or using a heat gun over 1100°F

- **What Are the Best Ways to Clean Dust?**

There are ways to clean your home that will help you reduce or prevent your family's exposure to lead dust. Here are some tips on how to clean your home in a lead-safe manner:

When Cleaning . . .	Do Use . . .	Don't Use . . .
Uncarpeted Floors	Damp or wet mop Cleaning sticks with disposable cleaning wipes (such as Swiffer) Sponge or cloth rags Vacuum cleaners with HEPA filters Regular vacuum cleaners with a "bare floor setting"	Mops with a scrubber strip attached Vacuums without a "bare floor setting A broom or other dry sweeping
Carpets & Rugs	Wet cloths to remove stains Steam cleaning methods HEPA Vacuum If using a regular vacuum cleaner, the surface should be gone over several times to maximize the dust pick up.	Shake or beat area rugs
Walls and other painted surfaces (furniture, doors)	Water with a household cleaner added Plain water for rinsing Soft rags or paper towels Cleaning sticks with disposable cleaning wipes (such as Swiffer)	Steel wool, scouring pads, and abrasive cleaners Solvent cleaners that may dissolve paint. Excessive rubbing to remove spots.

Figure 4.1 *Visual Triggers of Paint Hazards*, plus instructions for taking action to decrease possible lead hazards.

Lead information can be provided in settings such as:
- Well-child or HealthCheck visits
- Pre-school screening visits
- Head Start programs and home visits to families enrolled in Head Start
- Pre-natal and post-partum home or office visits
- Immunization clinics
- Women, Infants and Children (WIC) Nutrition Programs
- Child care facilities and pre-kindergarten and kindergarten classes

A comprehensive but easy-to-use tool (see Figure 4.2) developed by the National Center for Healthy Housing gives parents information about their child's blood lead level. The reverse side of the factsheet contains a checklist to guide parents in looking around their child's environment for a variety of possible sources of lead, such as paint that is in bad condition, bare soil, toys, candies, spices, drinking water, and work or hobbies. This can be used with pregnant women and families with infants to prevent lead exposure.

Figure 4.2 A factsheet and checklist to guide parents/caregivers in evaluating their child's environment for potential lead hazards.

Community Level Primary Prevention Activities

Identifying collaborators who can expand the capacity to provide education is key to community level primary prevention. Neighborhood or community-based primary prevention of childhood lead poisoning requires partnerships between local health departments, residents, property owners, community-based organizations, community leaders, and businesses. Their main activities should involve identifying, assessing, reducing, and monitoring lead hazards in a community or target neighborhood. The activities may focus on buildings where children younger than six years old reside or spend time on a regular basis, e.g., child care centers. Some or all of the following steps may be included in a community-based primary prevention initiative:

- Educate parents/caregivers, child care providers, tenants, health care providers, home owners, and community members about childhood lead poisoning.
- Train rental property owners and managers, and construction workers, how to recognize and control lead dust hazards.
- Engage local businesses to provide lead hazard reduction information to the community.

According to national surveys, more than 34 million homes have surfaces covered by lead-based paint and 24 million homes are estimated to have lead-based paint hazards (Jacobs, et al., 2002, Jacobs and Nevin, 2006, Levin, et al., 2008). These homes are mostly located in the northern states from the East Coast through the Midwest and Plains states; Figure 4.3 illustrates this trend.

Lead paint was used extensively in the 1930s and earlier. As lead paint deteriorates and falls, it leaves lead-tainted dust on horizontal surfaces of windows, floors and porches. The regions with older housing and more lead paint have more children found to be lead-poisoned. As indicated in Figure 4.3, like its neighboring states, Wisconsin has a very high proportion of homes built in the 1930s or earlier across the state.

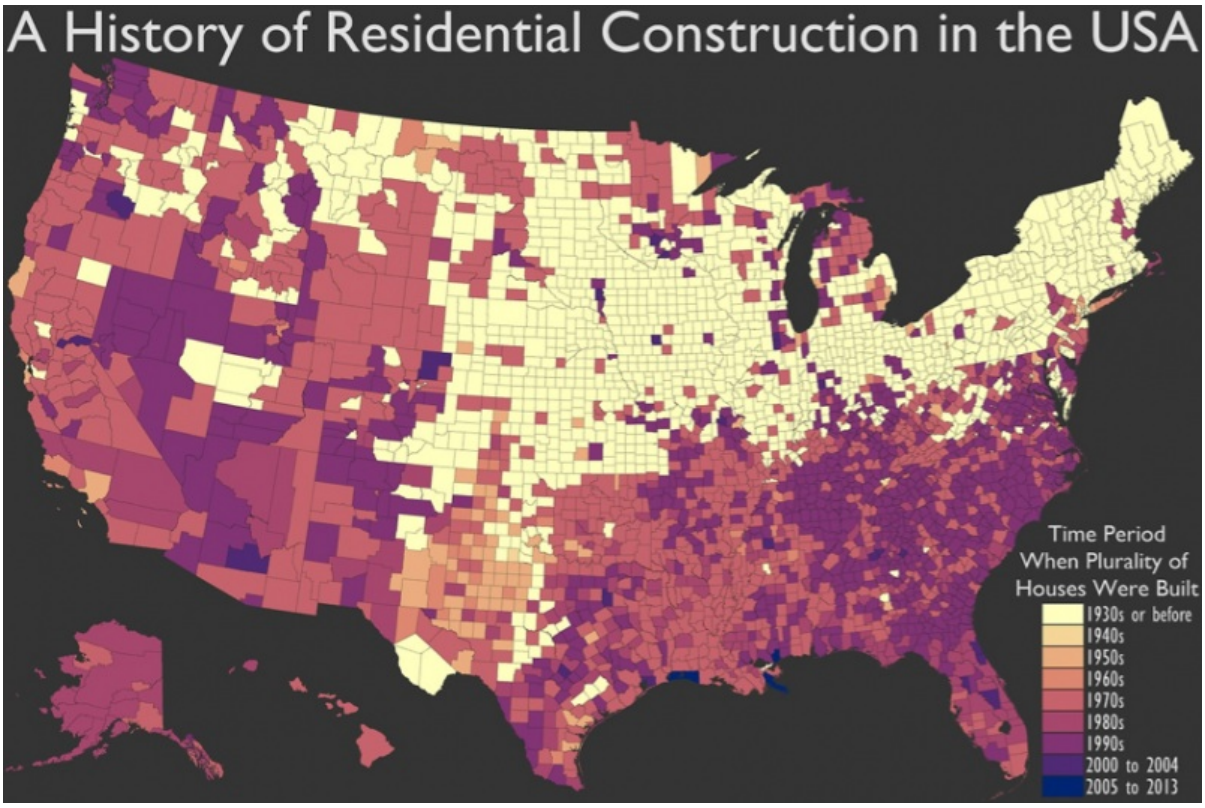


Figure 4.3 Map of U.S. showing counties that have a plurality of housing built before 1930 when the use of lead in paint was at its highest (Source: www.slate.com).

Housing-based Strategies

Mobilizing community efforts for primary prevention takes time, energy, and resources. Identifying and articulating common interests in reducing lead hazards helps to define strategies that will work locally to eliminate childhood lead poisoning.
To implement primary prevention strategies, the CDC recommends that local and state governments implement six housing-based strategies such as the following:

A. Target actions in pre-1978 properties according to known local risk factors.
B. Establish institutional linkages between public health programs and housing code enforcement agencies to prioritize rental properties based on previous code violations and reported blood lead levels above the reference value.
C. Enact preventive housing standards and policies for rental housing (multifamily and single-family) that mandate routine inspections and attention to lead hazards at unit turnover with clearance testing and visual inspection to ensure housing is lead-safe.
D. Enact preventive housing standards and policies for owner-occupied housing including enforcement of maintenance standards, visual inspection for paint issues prior to sale, and visual inspection and clearance dust testing after RRP work has been conducted.
E. Provide loans, grants, and other financial incentives for hazard remediation.
F. Assist families in taking protective actions such as learning basic tactics in visual inspection and proper maintenance.

The CDC, U.S. Department of Housing and Urban Development (HUD), and U.S. Environmental Protection Agency (EPA) have supported primary prevention activities in

Wisconsin for decades, with the purpose of modifying Wisconsin's housing stock, much of which contains lead-based paint. Listed below are the ACLPPP-recommended primary prevention actions (**in bold**) that have been taken at the federal, state and local levels. Included are examples of actions people have taken through their elected representatives in the federal, state and local governments to address lead hazards in housing.

A. ***Target actions in pre-1978 properties.*** In 2004, WCLPPP developed Geographic Information System maps showing high-risk areas by age of housing stock (based on percentage of pre-1950 housing in census tracts) and associated locations of dwellings that have had lead-poisoned children in residence for Wisconsin counties, municipalities and legislative jurisdictions. An example of a map for the city of Beloit is included below (Figure 4.4). The map shows that the majority of lead-poisoned children lived in neighborhoods with a high proportion of old housing. The cities of Racine and Waukesha used their maps to prove they knew where the highest risk housing is located in their communities and as a result received funding from the U.S. Conference of Mayors, Dupont *Lead-safe for Kids Sake* grant.

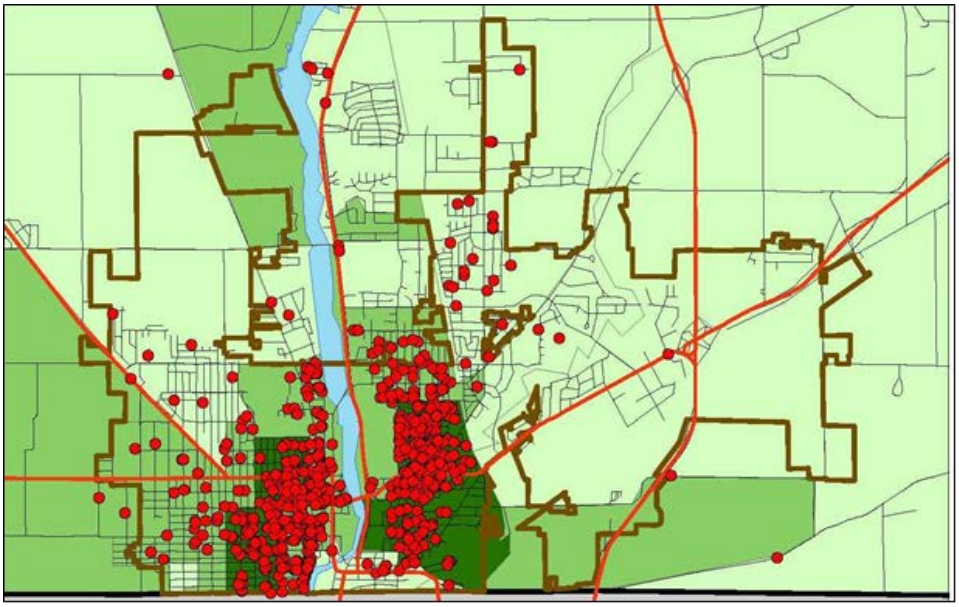


Figure 4.4 City of Beloit; red dots represent addresses of children with a blood lead level at or above 10mcg/dL in 1995 – 2001; darkest green represents census tracts where 66% or more of the homes were built before 1950.

B. ***Establish institutional linkages between public health programs and housing code enforcement agencies.*** At the federal level, CDC and HUD worked together to develop housing-based strategies for primary prevention.

At the state level, the Department of Health Services Division of Public Health (DPH), the Department of Administration, Division of Housing and Weatherization programs have worked together to obtain federal lead hazard control funds and to distribute these funds to local agencies that serve low to moderate-income households. DPH has also encouraged local health departments to work with housing agencies in their jurisdictions (e.g., Community Development Block Grant agencies) to address lead hazards in housing.

Locally, some municipalities have adopted city ordinances that include chipping and peeling paint as a violation of local housing code and can call the code enforcement agency to report the violation and write up work orders for the property owner to fix the hazards.

C. Enact preventive housing standards and policies for rental housing (multifamily and single-family) that mandate routine inspections and attention to lead hazards at unit turnover with clearance testing and visual inspection to ensure housing is lead-safe.

At the federal level, the U.S. government's largest housing support program, the Section 8 Tenant-Based Rental Assistance Program supports over 3 million households. In order to receive rental subsidies, property owners must maintain all painted surfaces in intact condition and submit to an inspection prior to occupancy and at least annually thereafter.

At the local level, the city of Beloit, persuaded by citizens from the community wanting to set standards for lead-safe rental housing, adopted a rental permit program. Any property owner who rents a residential dwelling must apply for a rental permit and pay an annual fee of $35. Owners must comply with building codes and maintain paint in good condition, free of lead hazards if the dwelling is used or occupied by children under age seven. The city inspects rental dwellings on a systematic basis (typically about every three years) and will deny a permit to any property not in good condition. When chipping or peeling paint is found in the dwelling the owner must stabilize the paint and have the property re-inspected before the owner can receive a rental permit. The city also offers low interest loans to owners who rent to limited-income families to help the owners comply with lead paint and other housing standards.

D. Enact preventive housing standards and policies for owner-occupied housing including enforcement of maintenance standards, visual inspection for paint issues prior to sale, and visual inspection and clearance dust testing after RRP work has been conducted.

In 2008, the federal government issued the EPA Renovation, Repair and Painting (RRP) rule that requires contractors who disturb paint on dwellings built before 1978 to be trained and certified in lead-safe work practices and take steps to limit dust exposure as they conduct work on a dwelling. Wisconsin worked quickly to implement the rules in 2009. Wisconsin contractors have enthusiastically embraced this rule and as of 2013, over 9,000 workers have been trained and certified to do lead-safe renovation or lead abatement. An informational pamphlet (see Figure 4.5) must be provided by the Lead-Safe Renovator to the customer before any renovation work is conducted.

Figure 4.5 EPA pamphlet with information on the RRP Rule.

Local health departments can help protect families in their communities from construction-related lead hazards and protect local contractors from unfair competition by encouraging all renovators and painters to follow lead-safe work practices and to get trained and certified as lead-safe renovators. How-to videos showing lead-safe work practices can be viewed on the Lead-Safe Wisconsin web page under the Contractor Certification/Licensing Info tab. If a violation of lead-safe work practices is suspected, the state Asbestos and Lead Program can be consulted at 608-261-6876.

The Wisconsin Department of Children and Families (DCF) requires that all regulated child care facilities must maintain paint in intact condition, affecting approximately 9,000 facilities and protecting all children whose families depend on these child care facilities. The presence of chipping and peeling paint is a violation of the child care facility code. The checklist used by DCF inspectors when conducting an inspection prior to issuing or renewing a child care license includes assessing for chipping and peeling paint. The child care operator must notify their DCF inspector prior to conducting remodeling, repair or re-painting of the child care facility. If the property was built prior to 1978, the child care operator must hire a Lead-Safe Renovator to conduct the work and must provide the EPA *Renovate Right* booklet to the parents of the children in their care. (See Chapter 2 for details on these rules and regulations.)

E. Provide loans, grants, and other financial incentives for hazard remediation:

Over the last 20 years, Wisconsin has succeeded in obtaining lead hazard reduction funds from HUD. Many communities that now have their own HUD lead grants have in the past received HUD lead grant funds from state of Wisconsin agencies (e.g., Department of Commerce, Department of Administration). These communities have become more independent by seeking their own funds and managing their own programs (e.g., cities of Milwaukee, Racine, Sheboygan and Waukesha and Kenosha and Rock Counties). As direct grant recipients, these agencies have captured proportionately more funds and can centrally manage their work. In many ways the scale and complexity of these grants makes them more efficient to manage at a local, county or regional level.

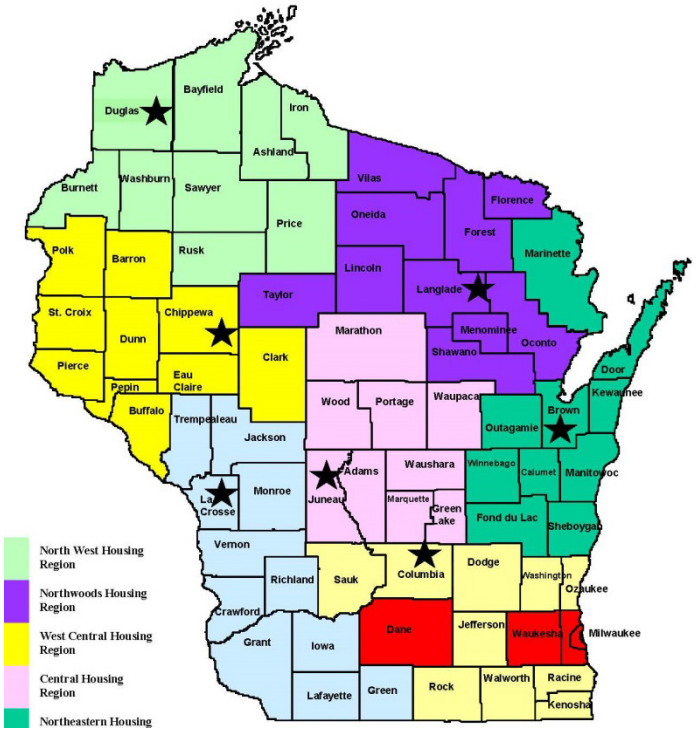


Figure 4.6 Regions receiving CDBG or HOME funds; star indicates the principal county contact for the region.

In addition, many community development programs have used Community Development Block Grant (CDBG) or HOME funds to fix lead hazards present in older homes. Agencies provide support via grants and/or loans to home owners in small and large communities and in rural housing. The CDBG Housing and HOME program funds are distributed between all Wisconsin counties except Dane, Milwaukee and Waukesha, which receive their own funds from CDBG. The state is divided into seven regions with a principal county contact in each region (see Figure 4.6) to administer the program. Homebuyers and home-owners seeking funds for rehabilitation and small public facility projects should contact the appropriate region for assistance.

F. Assist families in taking protective actions such as learning basic tactics in visual inspection and proper maintenance.

Home visiting before the child is out of the crib – Some local health departments have implemented primary prevention programs to find and correct lead hazards in older homes before the child is crawling. Rock County Health Department implemented the Birth Certificate Program in which a public health nurse and nursing student contact the family when the child is between six and nine months and conduct a home visit to do a visual assessment for potential lead-based paint hazards. When potential hazards are found, the nurse refers the family to the county's lead hazard reduction program for a lead risk assessment and lead hazard reduction work. Jefferson County Health Department piloted and adopted this program in 2012.

Home visiting before the child is born – During 2002 to 2006, a CDC-funded pilot program was implemented in Sheboygan County and the city of Racine with public health nurses (PHNs) in the Prenatal Care Coordination program. Public health nurses were trained and certified as Lead Sampling Technicians. When visiting with pregnant women living in homes built before 1978, the PHNs took dust wipe samples to detect the presence of lead on window wells, window sills and floors. When lead dust was identified, the PHN provided lead poisoning prevention information, cleaning demonstration and supplies such as buckets, detergent and HEPA vacuums. Dust lead levels were measured post-cleaning to determine whether a reduction in lead dust was achieved. The dust wipe results were also shared with the homeowner if the home was rental property. A sample dust wipe chart is included in Figure 4.7.

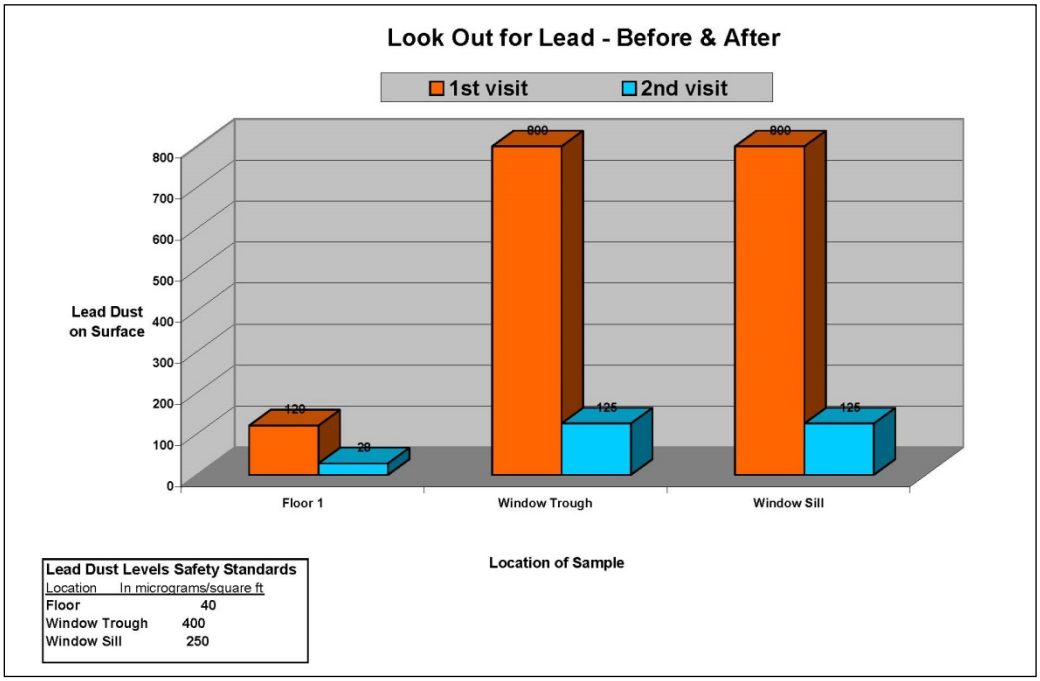
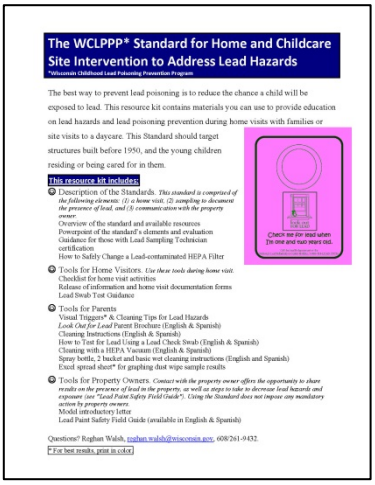


Figure 4.7 Example of dust wipe results before and after cleaning with HEPA vacuum and wet washing with grease-cleaning dishwashing detergent.

As a result of this pilot program, WCLPPP developed a toolkit for implementing this primary prevention program (see cover page in Figure 4.8). The toolkit is called *The WCLPPP Standard for Home and Child Care Site Intervention to Address Lead Hazards* (P-00716). It contains all the necessary materials to conduct the program, with the exception of the cleaning supplies. Several local health departments implemented this program, some using dust wipe samples, others using Lead Check Swabs to identify potential lead paint hazards. The City of Appleton Health Department has been using this home visiting program with success for a number of years.



The WCLPPP* Standard for Home and Childcare Site Intervention to Address Lead Hazards

*Wisconsin Childhood Lead Poisoning Prevention Program

The best way to prevent lead poisoning is to reduce the chance a child will be exposed to lead. This resource kit contains materials you can use to provide education on lead hazards and lead poisoning prevention during home visits with families or site visits to a daycare. This Standard should target structures built before 1950, and the young children residing or being cared for in them.

This resource kit includes:

- Description of the Standards. *This standard is comprised of the following elements: (1) a home visit, (2) sampling to document the presence of lead, and (3) communication with the property owner.*
  - Overview of the standard and available resources
  - Powerpoint of the standard's elements and evaluation
  - Guidance for those with Lead Sampling Technician certification
  - How to Safely Change a Lead-contaminated HEPA Filter
- Tools for Home Visitors. *Use these tools during home visit.*
  - Checklist for home visit activities
  - Release of information and home visit documentation forms
  - Lead Swab Test Guidance
- Tools for Parents
  - Visual Triggers* & Cleaning Tips for Lead Hazards
  - *Look Out for Lead* Parent Brochure (English & Spanish)
  - Cleaning Instructions (English & Spanish)
  - How to Test for Lead Using a Lead Check Swab (English & Spanish)
  - Cleaning with a HEPA Vacuum (English & Spanish)
  - Spray bottle, 2 bucket and basic wet cleaning instructions (English and Spanish)
  - Excel spread sheet* for graphing dust wipe sample results
- Tools for Property Owners. *Contact with the property owner offers the opportunity to share results on the presence of lead in the property, as well as steps to take to decrease lead hazards and exposure (see "Lead Paint Safety Field Guide"). Using the Standard does not impose any mandatory action by property owners.*
  - Model introductory letter
  - Lead Paint Safety Field Guide (available in English & Spanish)

Questions? Reghan Walsh, reghan.walsh@wisconsin.gov, 608/261-9432.

* For best results, print in color

Figure 4.8 Front cover of the toolkit described in this section.

Community-based Lead Outreach Program – Sixteenth Street Community Health Center (SSCHC), a federally qualified health care center on the south side of Milwaukee, has a lead outreach program (SSCHC LOP) that strives to reach parents of young children to make sure they get their children tested and proactively address any potential lead hazards in the home. Their evidence-based efforts (Schlenker et al., 2001) have been very successful in reducing the prevalence of lead poisoning (10 mcg/dL and greater) from 46.3 to 2 percent between 1996 and 2012. The SSCHC LOP actively partners with the Milwaukee Health Department CLPPP Primary Prevention Program to facilitate property owners' access to federal funds for lead hazard reduction. The SSCHC finds that 8.8 percent of children in their service area have BLLs greater than or equal to 5 mcg/dL (the new reference value), presenting a continued challenge for the program to protect children from further lead exposure.

Educating for Behavior Change

Education about the sources and risks of lead exposure, and the actions key parties can take to prevent or decrease exposure, is required to eliminate childhood lead poisoning.
The action objectives for childhood lead poisoning prevention programs and the community are three-fold:

1. To correctly address lead hazards in old homes,
2. To increase testing of those at risk for lead poisoning, and
3. To change policies to create systemic change.

The local health department plays an important role in providing the community with the information needed to implement and enforce actions that will lead to the elimination of childhood lead poisoning.

It is important for educators to plan ahead, consider the learning needs of the audience and how to best meet these needs (Andrews, 1999). This includes not only the language used (what is spoken and the education level), but also the interests and focus of the audience, the timing of the presentation, who the audience considers as trustworthy sources, as well as any cultural barriers that may affect how the information is received.
This section provides a brief background on the elements of educating for behavior change and strategies for presenting information to multiple audiences.

Elements of Educating for Behavior Change

The key elements of educating for behavior change include the following steps:

- Identify the Problem or Issue
- Identify the Ideal Behavior or Environmental Practice
- Identify the Target Audience – Primary and Secondary
- Identify Targeted Messages and How to Convey
- Identify Evaluation Strategy

At the end of this chapter is an example (Figure 4.9) of a Targeted Education Strategy that includes all the elements listed above.

Identify the Problem or Issue and Barriers or Misperceptions

The first step is to identify the problem or issue needing to be addressed. This may seem a rather obvious step in the process but there are subtleties that can make a significant difference. An example of a problem or issue is that too few of the children at risk for lead poisoning are being tested. Some health care providers may be reluctant to routinely test children because there is no effective medical treatment for lead poisoning and they are unaware of the services the local health department offers to families with a lead-poisoned child.

Identify the Ideal Behavior or Environmental Practice

The next step is to identify ideal behavior or environmental practice that will demonstrate a change in behavior. An ideal behavior or environmental practice is one that can be described as a single, observable action that meets the desired objective. It is preferable when deciding what action should be taken that it be the target audience's own action, not having something done *for* or *to* them. Continuing with the example of increasing testing of children for lead, an appropriate behavioral goal for health care providers would be to test more children for lead exposure.

Identify the Target Audience – Primary or Secondary

In getting more specific about the problem or issue, think about the recipient of the message. There are two types of audiences to be concerned with: *primary* and *secondary*. The primary audience is those people who perform the ideal behavior. The secondary audience is any group of people who influence the primary audience. Using the example above—increasing blood lead testing—the primary audience is typically health care providers, as they are the ones who order the blood tests. Another primary audience for blood lead testing may be the WIC and Head Start programs. Parents are the secondary audience because they seek advice and service from these professionals for the health and well-being of their children.

Once the audience has been identified, it is necessary to learn as much as possible about them, such as their characteristics, their likes, dislikes, and motivations. It is important to understand the supports and barriers that exist in their interactions with families. Focus groups are often used to identify these issues before developing any communications intended for the target group.

Identify Target Messages and How to Convey

Once the target audience has been identified, the message will be easier to develop. The communication should focus on persuading the target to do something--the more action-oriented, the better. People respond better if they are given some action to perform. Consider

both the benefits to the target if they take action and how their perception will change if they do take the intended action.

Answer the following questions when targeting a message:
1. What action should the target be persuaded to take?
2. What benefit will the target find most rewarding?
3. What realistic outcomes can be expected?
4. How can the target be effectively persuaded?
5. What images will best convey the message?

It is tempting to promise incredible outcomes if people change their behavior. Instead, the benefits should be focused on the individual and match the effort expended by the individual to change their behavior. In other words, if a do-it-yourselfer follows lead-safe work practices during remodeling, direct benefits might include no lead exposure to the worker and present occupants and a "lead-safe" house. There are other tangible outcomes, such as the home remodeler who uses lead-safe work practices, which protects future occupants, especially children, from lead poisoning—a benefit to the larger community. Don't exaggerate the extent to which the value of their home will increase as a result, because this may not occur. Remember, credibility is critical in the realm of public health.

The final step that must be considered in developing the message is how the target audience will be reached to achieve the greatest persuasive effect. Consider which medium will be most effective. Earlier, when considering the primary and secondary audiences, it was essential to consider the habits and motivations of these audiences. In other words, some groups may be influenced by something on television or the radio. Another audience may be more influenced by what they read on billboards because they spend time commuting by car. Signs on the bus or at the bus stops may also be an effective medium. Figure 4.9 is an example of a bus banner that the City of Racine has used as part of their education strategy. They also have posters with the same messages in public places such as at the library.

Figure 4.9 Bus banner used in education campaign in the city of Racine.

Sample Education Strategies:

- **Commitment to promote behavior –** Adopt an MOU (memorandum of understanding) between two parties. For example, the Tobacco Coalition, "Just Say NO!" campaign relied on a tacit agreement or promise to change behavior or practices.
- **Prompts to promote behavior –** Much of the printed, audio and visual media produced by profit and non-profit organizations is developed for this very purpose, to remind people to buy their product, follow their example and "do the right thing." Some examples of prompts are: stickers, door hangers, posters, "shelf-talkers" in building supply stores, billboards, and PSAs.

- **Norms to promote behavior –** People are influenced by what their families, neighbors, peers, colleagues, or authority figures believe or do. Take advantage of the influence of normative groups by getting endorsements from an organization like the American Academy of Pediatrics (AAP) for promoting blood lead screening or a local apartment owners association for promoting lead-safe housing. Another example of a normative strategy used in communities is placing a yard sign indicating the home has been made "lead-safe" or is "a child-healthy environment" in an at-risk neighborhood. Other residents or property owners may want the same protection or status for their home.
- **Remove barriers to behavior –** As mentioned before, it may be a lack of know-how that is keeping someone from changing the way they do things. So, for example, provide lead-safe work practice classes or how-to videos for do-it-yourselfers.

Identify Evaluation Strategy

Plan to evaluate your education efforts from the very beginning so you know (1) the outcome you want; and (2) how you will measure it. See the next section, *Planning for Evaluation*, for more details.

Planning for Evaluation

Evaluation should be conducted when targeting a specific group with a message. Knowing the desired outcome and how it will be measured is more likely to be meaningful in the long run. There are three things to bear in mind when planning to evaluate: accountability, strategic planning and common sense. Each has a separate consideration and the activity planned should reflect thought spent on each.

- **Accountability –** Choose an appropriate measure for your activity. If the goal or objective is to see a change in knowledge or attitude, a pre/posttest may be appropriate. To assess behavioral change, a pre/post observation of behavior is more appropriate. If the objective is to see people using lead-safe work practices, for example, the appropriate measure might be stopping at renovation job sites around the community and observing the renovator's compliance with the rules, such as using the appropriate length of 6 mil plastic for exteriors or interior floor coverings.
- **Strategic Planning** – Being strategic in planning for evaluation may seem obvious, but consider the desired long term outcome before beginning an educational activity. For example, if the objective is to change the behavior of rental property owners and managers to maintain their properties in a lead-safe manner, consider the steps that will likely result in this behavior change. Maybe education about lead-safe maintenance practices will not be sufficient for them to change their attitudes and practices. Many Beloit rental owners supported a rental permit program as a way to level the playing field and to set a common community housing standard. Communities can consider developing and adopting a local ordinance with enforcement and reward mechanisms as a strategy to improve housing conditions.
- **Common Sense –** Resources—time, money and energy—are not limitless. It's wise to spend time on activities that will accomplish something or attain the ultimate goal. For example, attending health fairs may be enjoyable and good public relations, but the impact may be limited because there is only a brief time to interact with the attendees. Considering this at the outset may save time and energy on something unlikely to attain the objective.

Types of Evaluation

Any education activity or program should have some type of evaluation; many use more than one—to answer different questions or needs. There are three different types of evaluation: formative, process and summative. Each plays a different role, comes into play at different times and has different costs.

- **Formative evaluation** (before) is done during the planning and preparation phase of the program. This type of evaluation is explorative qualitative work. Examples of formative evaluations are: focus groups, in-depth interviews, pre-testing, setting baselines and segmenting audiences. Formative evaluation can be very costly. If a large amount of money is going to be spent on communication or education activities, formative evaluation is worthwhile.
- **Process evaluation** (during) measures how the program is working in the present. It typically takes place after some activity has occurred, ideally early on in the project, to determine if the activities are going as planned and whether the program is achieving what it intended. Examples of process evaluation are the number of brochures mailed, number of applicants for a housing program, estimates of how often the message was seen, heard, etc., or if the survey respondents are giving useful feedback. Process evaluation is important to do to determine if any adjustments need to be made before proceeding. However, process evaluation stops short of measuring impact or outcomes.
- **Summative evaluation** (after) measures the outcomes and impacts of the program; it proves something was accomplished. An outcome is a direct result of the program, whether the audience understood the message in a presentation and took some action as a result. For example, if the activity is providing lead-safe renovator training to contractors, counting the number of contractors who took the training is measurable but is only an output of the program because nothing changed as a result of taking the training. In this example, the outcome is the number of contractors who receive a passing score on the test and follow through to get certified as lead-safe renovators. Summative evaluation addresses accountability—the outcomes that occurred.

Measuring impact goes another step further to answer the question of whether the outcomes made a difference in behavior. Using the example of providing contractors with training to become lead-safe renovators, we can measure the impact by tracking the number of violations of the RRP Rule in the area where the training was provided or among the contractors who received the training. If these contractors are found to violate lead-safe work practice rules less often, or if violations are reduced in the area where training was provided, these would be impact differences, an indication that the training program had an impact on behaviors and thus made a difference.

Sample Evaluation Strategies (Steelquist, 1993)

- **Measure of attendance:** Sign-up sheets, participant lists, audience counts, product counts, contact lists, catalogue of audience demographics
- **Measure of participant reactions:** Self-report/instructor, evaluation forms, program audit, exit interview, instructor logs, correspondence files, news clipping files
- **Measure of knowledge, attitudes, skills, awareness:** Peer review of materials, pre/post-test, certification exam, self-reflective writing, portfolio review, instructor logs, student journal, group self-assessment, polling, focus groups, informal consultation, skills demonstration, exit interview

- **Measure of behavior change:** Pledge, peer or participant-rated exercise, incentive award, informal follow-up, polling, focus groups, direct observation, photo documentation, measuring indicators

We increase the capacity to fight lead poisoning by building partnerships with other agencies, organizations and businesses that serve those we are trying to protect.

An example of an educational strategy using the *Six Elements of Educating for Behavior Change* is shown in Figure 4.10.

Figure 4.10 An Example of a Targeted Education Strategy

Identify Problem/Barriers	
PROBLEM • Lack of knowledge about the dangers of lead in the environment • Lack of knowledge about the costs of lead poisoning • Lack of knowledge about who is most susceptible	**BARRIERS/MISPERCEPTIONS** • People think lead is no longer in paint so no longer a problem. • Parents think lead in toys is the problem. • Don't realize it's the invisible dust, not just visible paint chips. • Believe cleaning and adequate nutrition are "good enough" solutions. • "Won't happen to us."
Identify Ideal Behavior or Environmental Practice	
Identify and correct lead hazards Get children tested for lead at appropriate ages Advocate for change in protective policy	
Identify Target Audiences – Primary & Secondary	
PRIMARY • Property owners • Parents of young children • Policymakers/legislators	**SECONDARY** • Head Start • Local health departments • Local LPP coalitions • Childcare providers • Community associations • Child advocate agencies • Environmental safety services

Identify Targeted Messages		
Lead Hazard Reduction • New windows remove primary lead risk and save energy, translates into money savings • Improves curb appeal • Reduces liability of poisoning a child living in the property	Health & Learning Effects • Learning disabilities • Lowered I.Q. • Behavioral problems • Hyperactivity • Attention Deficit Disorder • Speech delay • Hearing loss	Societal Costs • Special education • High school dropout rates • Teen pregnancy • Juvenile delinquency • Violent crime Prevention is cheaper!

Identify Education Strategies
Develop communication tools with key messages Distribute printed materials/resource toolkits Give presentations to your target primary or secondary audiences Provide readily available, valuable information (via website)

Identify Evaluation Strategies	
EXAMPLES • *Legacy of Lead Report 2008* – two years later still 10,000 hits per month to the website • Kids unleaded electronic newsletters – open rate is greater than 20% • Web page – consistently visited • Toolkits – used widely • Legislative Report SRJ 65 – requests from legislative staff for more information • Requests to do presentations	**MORE OUTCOMES** • Expand the number who can spread the message • Requests to share materials with their peers/ colleagues • Request for follow-up information • Audience attends policy hearings or rallies, sends postcards to their legislators

References

Andrews, E. *Educating About Behavior*. University of Wisconsin-Extension, 1999.

Centers for Disease Control and Prevention Advisory Committee on Childhood Lead Poisoning Prevention, *Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention,* January 4, 2012.

Jacobs, D. E., Clickner, R. P., Zhou, J. Y., Viet, S. M., Marker, D. A., Rogers, J. W., et al., 2002. "The prevalence of lead-based paint hazards in US housing." Environmental Health Perspectives 110:A599-A606.

Jacobs, D. E., Nevin, R. "Validation of a 20-year forecast of US childhood lead poisoning: updated prospects for 2010." Environmental Research, 2006, 102(3):352-364.

Levin, R., Brown, M. J., Kashtock, M. E., Jacobs, D. E., Whelan, E. A., Rodman, J., Schock, M. R., Padilla, A., Sinks, T. *Lead Exposures in US Children, 2008: Implications for Prevention.* Environmental Health Perspectives, 2008, 116(10):1285-1293.

Schlenker, T. L., Baxmann, R., McAvoy, P., Bartkowski, J., Murphy, A. *Primary Prevention of Childhood Lead Poisoning Through Community Outreach,* Wisconsin Medical Journal, 2001, 100 (8): 48-54.

Steelquist, B. *Common Evaluation Strategies*. Adapted from presentation handouts, PIE Program, 1993.

Chapter 5

Screening and Diagnosis of Childhood Lead Poisoning

Contents

In Brief: A Public Health Blood Lead Screening Program 5.2
Introduction 5.3
Glossary of Terms 5.3
Wisconsin's Blood Lead Screening Recommendations 5.3
Strategies Behind the Wisconsin Screening Recommendations 5.6
Blood Lead Tests 5.8
Other Tests 5.9
Requirements for Reporting Blood Lead Test Results 5.9
Evaluating a Screening Program 5.10
References 5.11

In Brief: A Public Health Blood Lead Screening Program

Goal	Activities
Describe high-risk populations in the community	• Identify characteristics of children in the community known to be lead-poisoned and the sources of exposure. • Identify locations of children who share these risks. • Map locations of children tested, lead poisonings, and age of housing.
Assure blood lead testing is accessible and available	• Determine providers (e.g., WIC projects, HealthCheck providers, Federally Qualified Health Centers, local clinics, etc.) that provide health care services to identified at-risk populations. • Assess barriers to families in obtaining blood lead tests. • Establish collaborations to facilitate testing of at-risk children. • Identify resources for affordable venous blood lead tests for uninsured families.
Monitor local blood lead testing practices	• Assess proportion of high risk population, e.g., Medicaid or WIC, who are tested. • Assess timeliness of venous confirmatory and follow-up tests. • Work with Wisconsin Childhood Lead Poisoning Prevention Program (WCLPPP) to obtain provider or site specific test data to determine lead testing trends.
Provide information about blood lead testing to health care providers and parents of young children	• Assess knowledge of staff at local health care facilities about lead poisoning, blood lead testing recommendations, current protocols for follow-up testing and clinical management, and the health department role. • Encourage health care providers in the community to utilize the Wisconsin Blood Lead Registry to ascertain the blood lead test histories of their pediatric patients. • Develop strategies to provide information on testing to health care staff and to establish effective communication about children with lead poisoning. • Develop strategies to effectively communicate to parents of children aged 0-5 about lead exposure and blood lead testing. • Identify a desired outcome for educational interventions.

Introduction

Screening programs identify persons who have a particular health condition, e.g., lead poisoning, among a group of apparently well people. Without screening programs, persons with adverse health conditions may not be aware of the condition. Usually those with positive results from a screening program require additional diagnostic testing. The results of a screening program should benefit the individual being screened as well as the community because earlier detection and treatment of the disease may prevent severe and costly consequences from occurring.

Blood lead testing is the screening strategy used to identify children who are lead poisoned so that appropriate measures can be taken to identify and eliminate lead hazards, and minimize the length of time the child is exposed.

Glossary of Terms

The terminology used to discuss the process of identifying children at risk and providing diagnostic and treatment services can be confusing. Table 5.1 is a glossary of terms used by the Wisconsin Childhood Lead Poisoning Prevention Program (WCLPPP), adapted from the Centers for Disease Control and Prevention (CDC) and Wisconsin statute.

Wisconsin's Blood Lead Screening Recommendations

The Wisconsin Blood Lead Screening Recommendations were developed in 1998 based on recommendations from a broad-based advisory committee and guidance from the Centers for Disease Control and Prevention (CDC, 1997). These guidelines recommend targeted screening of children who are at greatest risk for lead poisoning and incorporate the 1992 federal requirement that all Medicaid-enrolled children receive blood lead tests at age 12 months and 24 months, and through age 5 if not previously tested. The guidelines are summarized in Table 5.2 and Figure 5.1.

The screening recommendations include universal testing of all children living in the cities of Milwaukee and Racine. Because of the extremely high proportion of old housing in these communities, and therefore the high risk of lead poisoning, each child should have a blood lead test three times before age 3: around 12 months, 18 months and 24 months. When seeing children from all other areas of Wisconsin, health care providers are encouraged to use the *Four Easy Questions* to determine whether a child is at risk for lead poisoning and needs to be tested:

1. Does the child now live in or visit a house built before 1950, or have they ever lived in one in the past (including child care, homes of friends, grandparents, relatives)?
2. Does the child now live in or visit a house or building built before 1978 with recent or ongoing renovations or have they ever in the past (including child care, homes of friends, grandparents, relatives)?
3. Does the child have a brother, sister or playmate who has/had lead poisoning?
4. Is the child enrolled in Medicaid or WIC?

TABLE 5.1 GLOSSARY

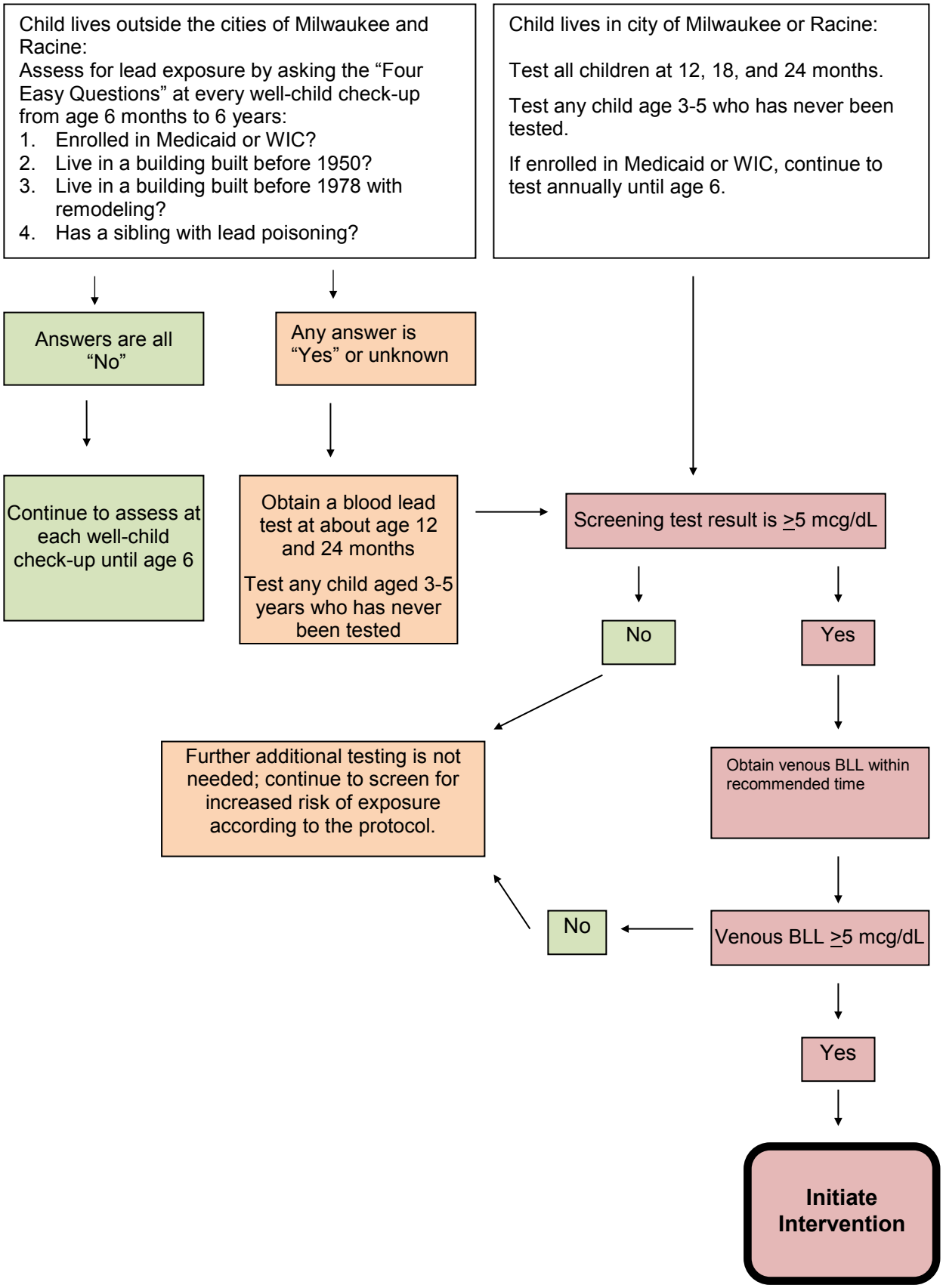
TERM	DEFINITION
Blood Lead Screening Test	Any test, capillary (fingerstick) or venous, for a child who had no previous venous blood lead level ≥5 mcg/dL.
Targeted Screening	The blood lead testing of some, but not all, children in a defined geographic area based on assessment of the presence of a factor(s) that places them at increased risk for lead exposure.
Universal Screening	The blood lead testing of all children in a defined geographic area at recommended ages (minimally at ages 1 and 2 years, or at age 3-5 years if they have never had a test done before).
Diagnostic Test	A venous blood lead test. If the screening test is venous, it is also a diagnostic test.
Confirmatory Test	The first venous test following a capillary screening blood lead test results ≥5 mcg/dL. All capillary tests ≥5 mcg/dL should have a venous confirmation test. A second capillary test done within 12 weeks of the initial capillary screening test can also be considered a confirmatory test.
A Follow-up Test	A blood lead test (venous if possible) following a venous blood lead level ≥5 mcg/dL.
Reference Value for Childhood Blood Lead Level	A reference value of 5 mcg/dL was established by CDC in 2012 based on the 97.5th percentile of the population BLL in children aged 1-5. The reference value will be updated by CDC every four years based on the most recent U.S. population blood lead surveys (NHANES) among children in the U.S.
Lead Poisoning or Lead Exposure (definition in Wisconsin Statute)	A blood lead level ≥10 mcg/dL [Wis. Stat. 254.11(9)].
Elevated Blood Lead Level (definition in Wisconsin Statute)	One venous blood lead level ≥20 mcg/dL or 2 venous blood lead levels ≥15 mcg/dL at least 90 days apart [Wis. Stat. 254.11(5m)].

Table 5.2 Wisconsin blood lead screening recommendations

Recommendations for Wisconsin outside the cities of Milwaukee and Racine	
Age	Recommendation
12 months *and* 24 months	Ask the Four Easy Questions (see below) Test if any one answer indicates a risk of exposure or the child is enrolled in Medicaid or WIC
36 – 72 months	If no record of previous test, ask the *4 Easy Questions* Test if any one answer indicates a risk of exposure or the child is enrolled in Medicaid or WIC
Four Easy Questions 1. Does the child now live in or visit a house or building built before 1950 or have they ever in the past? (include places such as day care, home of friends, grandparents or other relatives) 2. Does the child now live in or visit a house or building built before 1978 with recent or ongoing renovations or have they ever in the past? (include places such as day care, home of friends, grandparents or other relatives) 3. Does the child have a brother, sister or playmate who has/had lead poisoning? 4. Is the child enrolled in Medicaid or WIC?	

Recommendations for the cities of Milwaukee and Racine	
Age	Recommendation
Under 3 years	Test around 12 months Test around 18 months Test around 24 months
3 – 5 years	Children enrolled in Medicaid, WIC or uninsured: Test around 36 months Test around 48 months Test around 60 months
	Any child: Test if no record of prior test Test if lives in house built prior to 1978 with recent or ongoing renovations Test if child has sibling or playmate with lead poisoning Test if lives in a house built before 1950 (Racine only)

Figure 5.1 Screening Wisconsin children for lead poisoning



Strategies Behind the Wisconsin Screening Recommendations

Lead poisoning is the major environmental health threat to young children. Early detection and follow-up of lead poisoning remains a priority in Wisconsin. The Wisconsin Blood Lead Screening Recommendations are based on the high risk of lead exposure to Wisconsin children due to the extent of old housing throughout the state. The screening recommendations reflect four strategies to achieve early detection and intervention:

1. **Assessing risk for lead exposure and age-appropriate blood lead testing becomes a standard for pediatric preventive health care.**
   Assessing a child's risk for lead exposure and testing children based on risk are essential components of routine well-child care. This practice is a nationally recognized standard of the American Academy of Pediatrics (AAP) and is included in the Recommendations for Pediatric Preventive Health Care for all children aged 6 months to 6 years.

2. **The child's environment is considered the primary risk factor for lead exposure.**
   The child's environment poses the greatest risk for lead poisoning. Blood lead screening tests are targeted for those children living in high-risk environments.

3. **Children receiving publicly funded health care services are at high risk for lead exposure because they are low income and likely to live in older homes.**
   In many Wisconsin communities, access to safe affordable housing may be limited for low-income families. As a result, these families tend to live in housing that is older, poorly maintained and more likely to have lead-paint hazards. These children should be a focus of lead screening programs.

   The Wisconsin Medicaid Program and Wisconsin WIC Program have collaborated with the WCLPPP in linking program data to determine blood lead testing and lead poisoning among Medicaid-enrolled and WIC-enrolled children. This linking has demonstrated that children who are enrolled in either of these programs are at much higher risk of lead poisoning than children who are not enrolled in either program. From 2006 to 2010, 89% of Wisconsin children with a blood lead level (BLL) $\geq$10 mcg/dL and 77% of children with a BLL $\geq$5 mcg/dL were enrolled in one or both of these programs. In 2010, the prevalence rate of lead poisoning among children enrolled in Medicaid or WIC was three times higher than among children who were not enrolled in either of these programs. This has led to ongoing efforts within Wisconsin to assure compliance with the Medicaid testing requirement, and to support blood lead testing at WIC project sites.

4. **Children aged 1 and 2 are most vulnerable to lead toxicity.**
   Blood lead levels tend to be highest among children between the ages of 12 and 36 months. Children aged 1 and 2 are at greatest risk for lead poisoning because of:
   - increasing mobility during the second year of life, resulting in greater access to lead hazards that exist within their environment.
   - frequent hand-to-mouth activity.

   The reasons for increased susceptibility of young children to lead toxicity are described in this excerpt from Lead Poisoning in Childhood (Pueschel, S., Linakis, J, Anderson, A; p. 50):

   > First, at this age, children master ambulation and become capable of exploring all corners of their environment, finding lead sources previously unavailable to them. Second, toddlers receive relatively less parental attention than infants, providing greater opportunity for unsupervised hazardous behaviors. Third, young children, in

exploring their environment, often spend a considerable amount of time at the window, a site that tends to have high concentrations of lead, usually in the form of easily absorbed dust. Fourth, toddlers have not only developmentally appropriate hand-to-mouth activity but also a high rate of pica (i.e., the repeated ingestion of non-food substances). Fifth, toddlers have a high prevalence of iron deficiency, which increases gastrointestinal absorption of ingested lead. Finally, gastrointestinal absorption of ingested lead is inversely related to age. Although adults absorb only 10 to 20 percent of lead, young children absorb 30 to 50 percent.

Blood Lead Tests

Testing of whole blood for lead is the screening and diagnostic test of choice for lead poisoning and is the most widely accepted and commonly used measure of lead exposure. A blood lead test is a direct measurement of the concentration of lead in blood. It reflects the dynamic equilibrium between absorption, excretion, and deposition in soft tissue, blood, and bone, and is usually reflective of recent environmental exposure.

Since blood collected by venipuncture has a low likelihood of contamination compared to blood collected by fingerstick, venous blood is the preferred specimen for analysis and should be used for lead measurement whenever practicable. In addition, venous specimens provide a larger volume for analysis and are less prone to clotting and other problems that can be encountered with capillary specimens. However, collection of venous blood from children is sometimes difficult; thus, capillary blood from a fingerstick is acceptable for blood lead screening, provided that special collection procedures are followed to minimize the risk of contamination. Personnel should be thoroughly trained in proper collection procedures. The recommended procedure for the collection of blood lead specimens by fingerstick is available from the Wisconsin State Laboratory of Hygiene. An abbreviated fingerstick collection procedure is also available. Supplies for obtaining capillary blood specimens can be obtained from the Wisconsin State Laboratory of Hygiene (WSLH) by calling 800-442-4618.

Elevated blood lead results obtained on capillary specimens should be considered presumptive and should be confirmed using venous blood. See Table 5.3 for the recommended schedule for obtaining a confirmatory venous sample (CDC, 2012). In general, the higher the blood lead level (BLL), the sooner the confirmatory test should be done. The CDC recommends that BLLs of 10 – 44 mcg/dL be confirmed within one week to one month, noting that the higher the BLL on the screening test, the more urgent the need for confirmatory testing. Children whose BLL is at the upper end of this range should receive a confirmatory test in approximately one week if possible.

In the event that it is not possible to obtain a confirmatory venous sample from the child, a second capillary sample drawn within 12 weeks of the initial screening test can be considered a confirmatory test. This is consistent with the standard surveillance definitions used by the CDC to classify confirmed and unconfirmed elevated BLLs. If the second capillary test result is elevated, all follow-up tests should be performed on venous samples.

Recommended schedule for obtaining a confirmatory venous sample

Blood lead level (mcg/dL)	Time to confirmation testing
≥ 5 – 9	1 – 3 months
10 – 44	1 week – 1 month*
45 – 59	48 hours
60 – 69	24 hours
≥ 70	Urgently as emergency test

* The higher the BLL on the screening test, the more urgent the need for confirmatory testing.
Source: Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, Centers for Disease Control and Prevention, January 4, 2012.

Other Tests

There is no medical foundation for relying on the following methods to diagnose overexposure to lead: gingival lead lines; testing of neurophysiologic function; evaluation of renal function (except during chelation with Calcium Disodium Versenate ($CaNa_2$ EDTA); testing of hair, teeth, packed red cells, saliva or fingernails for lead; and radiographic imaging of long bones, nor is provocative chelation prior to measurement of lead in urine testing recommended (CDC, 2012).

Requirements for Reporting Blood Lead Test Results

State law (Wis. Stat. 254.13) requires that all blood lead test results on Wisconsin residents be reported to the Department of Health Services (DHS). The specific requirements for reporting blood lead results, such as timetable, content, form, etc., are described in Wis. Admin. Code 181. The WCLPPP implements the reporting rule through a laboratory-based reporting system and works directly with laboratories to assure all blood lead results are reported. Health care providers are responsible for sending complete demographic information as required by Wis. Admin. Code 181 to the analytical laboratory with each blood lead sample. This allows the laboratory to include the demographics in the blood lead report.

Health care providers that conduct on-site blood lead testing using the LeadCare II are responsible for reporting these test results to the WCLPPP. These sites should use the DHS Blood Lead Lab Reporting (F-00017) (see Appendix A) or a comparable form for reporting blood lead results.

A WIC project that uses the LeadCare II must assure the results are reported to the WCLPPP on a timely basis. To do this, WIC staff should notify the WCLPPP when they begin using the LeadCare II. WIC staff should enter all LeadCare II results into the ROSIE database. The WCLPPP will then obtain the results through a weekly electronic report from the ROSIE data system. If WIC or the local health department uses the LeadCare II to test children who are not enrolled in WIC, the agency must report the results to the WCLPPP using the DHS Blood Lead Lab Reporting (F-00017) (see Appendix A) or a comparable form.

The timetable for reporting is specified in Wis. Admin. Code 181:

- BLLs <10 mcg/dL within 30 days
- BLLs 10 – 44 mcg/dL within 48 hours
- BLLs ≥45 mcg/dL within 24 hours

Blood lead reports can be mailed or faxed to the WCLPPP. The mailing address is:

Wisconsin Department of Health Services
Division of Public Health
WCLPPP, Rm. 145
P.O. Box 2659
Madison, WI 53701-2659

The WCLPPP fax number is 608-267-0402. For questions about reporting blood lead results, contact the WCLPPP at 608-266-5817.

Evaluating a Screening Program

The local health department (LHD) contracting with DHS for childhood lead poisoning prevention funds should assess the availability and accessibility of blood lead testing for high-risk children in their jurisdiction. The LHD may or may not directly collect blood lead samples, but should evaluate whether children at high risk for lead exposure are being tested, and determine the barriers to testing and how these barriers can be addressed. The LHD can review blood lead data for their jurisdiction to determine the adequacy of testing among target populations, incidence and prevalence of lead poisoning, and timeliness of confirmatory and follow-up blood lead tests.

To evaluate the effectiveness of a blood lead screening program, the following outcome measures can be monitored:

- Number of children tested by age cohort
- Percent of children enrolled in Medicaid and/or WIC who were tested
- Positive screening rate (percent of those tested who have a BLL $\geq$5 mcg/dL) by age cohort
- Timeliness of confirmatory tests for children with elevated capillary screening tests
- Timeliness of follow-up tests for children with venous BLLs $\geq$5 mcg/dL

Blood lead data can be collected in various data systems. The STELLAR system is used by WCLPPP and some LHDs for blood lead surveillance and tracking public health services provided to children with lead poisoning. Blood lead results for WIC participants can be recorded in the WIC ROSIE system. The SPHERE system can be used to record blood lead results and public health services. The LHD can use the data system that best suits their needs, computerized or paper, to monitor and evaluate their lead screening program.

Beginning in 2011, access to the Wisconsin Blood Lead Registry (WBLR) is available upon request to health care providers who have direct authority for a child's medical and testing care. These providers include primary care providers, managed care organizations, public health workers, and Wisconsin school systems. The WBLR is a web-based data system that is accessed through the Wisconsin Immunization Registry (WIR) secure network and contains all blood lead test results for Wisconsin children, regardless of where they were tested. Once granted access privileges, providers are able to check whether a child is due for a blood lead test or has a history of lead poisoning at the same time that they check the child's immunization history. The WCLPPP staff uploads new blood lead test results to the WBLR on a weekly basis. For more information about the WBLR and how to gain access privileges, contact the WCLPPP at 608-266-5817.

References

Centers for Disease Control and Prevention. (1997). Screening Young Children for Lead Poisoning: Guidance for state and local public health officials. Atlanta: CDC. *http://www.cdc.gov/nceh/lead/publications/screening.htm*

Centers for Disease Control and Prevention. (2012, January 4). *Low level lead exposure harms children: A renewed call for primary prevention, report of the advisory committee on childhood lead poisoning prevention of the Centers for Disease Control and Prevention.* Atlanta: CDC. http://www.cdc.gov/nceh/lead/ACCLPP/Final_Document_030712.pdf

Centers for Disease Control and Prevention. (2012, June 7). *CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in "Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention".* Atlanta: CDC. http://www.cdc.gov/nceh/lead/ACCLPP/CDC_Response_Lead_Exposure_Recs.pdf

Pueschel, S., Linakis, J., Anderson, A. (1996). *Lead Poisoning In Childhood,* Paul H. Brookes Publishing, Baltimore, MD.

Schlenker, T., Fritz, C., Mark, D., Layde, M., Linke, G., Murphy, A., & Matte, T. (1994). Screening for pediatric lead poisoning. *Journal of American Medical Association,* 271, 1346-1348.

Stanton, Noel V. (2000). Erythrocyte protoporphyrin, *Therapeutic Drug Monitoring and Toxicology,* American Association for Clinical Chemistry, Inc.

U.S. Environmental Protection Agency. (1999). Lead exposure associated with renovation and remodeling activities: Wisconsin childhood blood lead study. Washington, DC: EPA

U.S. General Accounting Office. (1999). Lead Poisoning: Federal Health Care Programs Are Not Effectively Reaching At-Risk Children (Publication No. GAO/HEHS-99-18).

Valanis, B. (1986). Epidemiology in nursing and health care. Norwalk, CT: Appleton-Century-Crofts.

Weitzman, M., Glotzer, D. (1992). Lead poisoning. *Pediatrics in Review* 13 (12), December 1992, pp. 461-468.

Chapter 6

Nursing Case Management of a Child with Lead Poisoning

Contents

Introduction 6.2
Assessing the Child 6.4
Educational Interventions for Parents/Caregivers 6.5
Developing a Plan of Care 6.6
Referrals to Community Resources 6.7
Coordinating Services 6.8
Evaluation of Care 6.8
Case Closure 6.9
References 6.10

Introduction

This chapter describes nursing case management activities for the child with lead poisoning. The purpose of case management for lead poisoning is to eliminate the source of lead exposure for the child as quickly as possible and provide optimal benefit for the child's long-term success. One goal of case management for lead poisoning is to assure that children receive appropriate diagnostic and treatment services (including medical, environmental and other services). This involves coordination of efforts among multiple service providers. Case management involves assessment, problem identification, planning, monitoring, evaluation, referral, and advocacy. It is based on the efforts of an organized team that may include the public health nurse (PHN), the child's caregivers, the medical provider, a lead risk assessor (RA) or lead hazard investigator (LHI), and others, including educators, social workers or housing agency staff. Effective case management includes ongoing communication with caregivers and other service providers, and cooperative approaches to solving any problems that may arise during efforts to decrease a child's BLL and eliminate lead hazards in the child's environment.

In January 2012, the Centers for Disease Control and Prevention (CDC) established a new reference value for a child's blood lead level (BLL) of 5 mcg/dL. The CDC also published recommendations for actions based on the new reference value (see Table 6.1). All children with a BLL ≥5 mcg/dL should receive some form of intervention to reduce their exposure to lead hazards. The intensity and depth of this intervention will vary depending on local policies and resources. Where feasible, the LHD should first give priority to children with the highest BLLs. Beyond this, interventions should be targeted at those under 2 years of age because lead exposure is more likely to result in a rapid increase in BLLs in very young children.

Table 6.1 CDC and Wisconsin recommended actions based on blood lead level

Venous Blood Lead Level (mcg/dL)	Interventions
<5	• Lead education – dietary and environmental • Environmental assessment* for pre-1978 housing • Follow-up BLL monitoring
≥ 5 – 44	Actions for previous level plus: • Environmental investigation and lead hazard reduction • Complete health history and physical exam • Lab work – iron status and consider hemoglobin or hematocrit • Neurodevelopmental monitoring • Abdominal x-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated • Erythrocyte protoporphyrin laboratory test at BLL of 20 mcg/dL or greater**
45 – 69	Actions for previous level plus: • Erythrocyte protoporphyrin laboratory test • Oral Chelation therapy (consider hospitalization if lead-safe environment cannot be assured)

Venous Blood Lead Level (mcg/dL)	Interventions
≥ 70	• Hospitalize and commence chelation therapy (following confirmatory venous blood lead test) in conjunction with consultation from a medical toxicologist or a pediatric environmental health specialty unit • Proceed according to actions for 45-69 mcg/dL

*The scope of an "environmental assessment" will vary based on local resources and site conditions. This would include at a minimum a visual assessment of paint and housing conditions, but may also include testing of paint, soil, dust, water and other lead sources. This may also include evaluating potential exposure from items in the home such as imported cosmetics, traditional remedies, medicinal powders, pottery, food, toys, hobbies and occupational exposures.

** An EP test should routinely be obtained on any child with a diagnostic BLL ≥20 mcg/dL, and paired with any follow-up BLLs that are drawn (see Figure 8.1. Usefulness of Erythrocyte Protoporphyrin Tests in Children with Elevated Lead Levels).

Source: "Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention," Centers for Disease Control and Prevention (CDC), January 4, 2012

While BLL alone does not always indicate the need for complex interventions, the higher the BLL the greater the diversity of services usually required. The emphasis of these services depends on the medical, social, environmental, and financial needs of the family.
In Wisconsin, the local health department (LHD) contracting with the Department of Health Services (DHS) to provide childhood lead poisoning prevention services is required to provide nursing case management activities for all children with an "*elevated blood lead level*" (EBLL). An EBLL is defined in Wis. Stat. 254.11(5m) to mean one venous BLL ≥20 mcg/dL or two venous BLLs ≥15 mcg/dL that are drawn at least 90 days apart.

Home visits are the optimal venue in which to assess the source of a child's lead exposure. If resources are limited, the LHD may be able to provide letters or phone calls to families of children with lower levels of lead exposure (e.g., BLLs of 5-14 mcg/dL). Other LHDs may be able to conduct an assessment of the child and education with the family during a public health office visit or WIC clinic visit.

The PHN most often plays a central role in assessing the child and assuring effective interventions are provided to limit the child's lead exposure. Once a child is identified with an EBLL, the nurse case manager should do the following:

1. Visit the child's residence (and other sites where the child spends significant amounts of time) at least once. A second visit to the home is strongly recommended.
2. Assess factors that may impact the child's BLL (including the conditions of painted surfaces in the dwelling, other potential sources of lead, nutrition, access to services, family interaction, and caregiver understanding).
3. Assess the child's health and developmental status.
4. Provide education to the parents/caregivers.
5. Refer the family to other service providers as appropriate.
6. Coordinate services and communicate with members of the case management team.
7. Evaluate the outcome(s) of interventions and referrals; revise the care plan as needed.

A RA/LHI should also visit the child's residence to conduct a thorough investigation of the home and identify sources of environmental lead exposure (see Chapter 7. Environmental Assessment). The case management team can then use the results of this investigation to develop a plan to protect the child and correct hazardous conditions.

Treatment of childhood lead poisoning can have many complicating factors. The LHD staff can contact the WCLPPP (608-266-5817) for consultation on cases that do not conform to normal procedures and interventions, or when unfamiliar with unusual exposure sources, chelation, or other treatment and follow-up protocols.

Assessing the Child

Assessment of the child with lead poisoning is a vital component of nursing case management. The assessment provides the basis to plan interventions to reduce lead exposure and make appropriate referrals. The assessment includes the child's health status, development status, behavior, nutrition and risk factors for lead exposure. Another important part of this assessment is to determine the primary concerns of the family related to lead poisoning, and identify other family issues that may influence the child's BLL.

Assessing the lead-poisoned child in the home environment allows observation of possible sources of lead exposure and the child's access to any deteriorated painted or varnished surfaces.

Assessment of Health Status

An assessment of the overall health of the child with lead poisoning provides a baseline and allows the PHN to identify concurrent medical conditions that may influence the child's response and resiliency to lead poisoning. The assessment includes obtaining a thorough health history from the parent/caregiver and a limited physical assessment. The PHN should determine if the child has a history of lead exposure/poisoning. Blood lead results can be viewed through the Wisconsin Immunization Registry or can be obtained by contacting the WCLPPP.

Developmental and Behavioral Assessment

Because the primary toxicity of lead poisoning in young children is to the brain and central nervous system, the PHN should conduct a developmental screening test (such as Ages and Stages Questionnaire) during the home visit. The PHN can also refer the child to a local community program that administers developmental screening tests. This assessment will determine a baseline by which future changes can be weighed, as well as identify the need for referrals to assist the child and family in addressing any delays as soon as possible. If delays are noted in the screening test, a referral should be made to the child's physician or the Birth to Three Program for a thorough developmental assessment. (See Chapter 10 for more information on developmental assessment and interventions.)

Nutritional Assessment

Nutrition is an important factor in managing lead poisoning. Certain nutrients, such as iron and calcium, may reduce the child's absorption of lead. Children with elevated blood lead levels are often at risk for poor nutrition, and their caregivers should receive nutritional counseling to help these children obtain a well-balanced and age-appropriate diet. (See Chapter 9 for more information on nutrition and lead poisoning.)

Assess Other Risk Factors for Lead Exposure

The PHN should look for and ask about risks for lead exposure in the child's environment. Lead-based paint and lead-contaminated dust are the primary sources of exposure for children. If the PHN visits the child's home before the lead risk assessor/hazard investigator conducts the

property investigation, the PHN should walk through the interior and exterior of the residence with the parent/caregiver to look for possible lead hazards. If the PHN identifies possible sources of lead, the parent/caregiver can be instructed on how to use a home test kit., e.g., 3M™ LeadCheck Swabs or ESCA Tech D-Lead® to identify the presence of lead in the environment.

Other risk factors for lead exposure may include, but are not limited to, the following:

- Iron deficiency (often co-exists with lead poisoning and can potentiate central nervous system effects).
- A history of pica, persistent chewing on varnished or painted surfaces, evidence of frequent hand-to-mouth activity (such as thumb sucking), or accidental ingestion of any non-edible substance.
- Infrequent handwashing, especially after play, before eating and napping.
- Use of imported cosmetics or home/traditional remedies that may contain lead.
- Home has vinyl mini/vertical blinds that may contain lead.
- Parents or other household members engage in a lead-related occupation or hobby.

For more information on other risk factors for lead exposure, see Chapter 3.

Educational Interventions for Parents/Caregivers

Educational interventions with parents/caregivers are vital to prevent or limit children's exposure to lead (see Chapter 4. Primary Prevention and Educating for Behavior Change). Many parents/caregivers have little understanding of the risks of lead poisoning, the sources of lead, the impact of lead toxicity on young children, and steps they can take to prevent lead exposure.

Public health professionals are often the most knowledgeable resource within a community about childhood lead poisoning. Therefore, public health staff may be the primary source of information for families of lead-poisoned children. This information should include the following important topics:

- Child's BLL and what it means.
- Sources of lead exposure.
- Reducing the sources of lead to decrease the duration of exposure.
- Role of the risk assessor and what will happen during and as a result of the environmental investigation for lead hazards.
- Temporary measures the parent can take to decrease lead exposure (wet cleaning areas with lead paint chips and dust; blocking access to lead hazards; handwashing before naps, meals, and after play; using only cold tap water for food and formula preparation, and flushing pipes each morning).
- Follow-up blood lead testing schedule (see Table 6.2).
- Medical examination.
- Neurodevelopmental assessment.

- Adequate intake of certain nutrients, such as iron and calcium.
- Potential for the child to develop learning or behavior problems at a later age.
- Testing of siblings under 6 years of age.
- Testing pregnant women who live with someone with an elevated blood lead level.
- Chelation protocols if appropriate.

Table 6.2 Schedule for follow-up blood lead testing[a]

Venous Blood Lead Level (mcg/dL)	Early Follow-up Testing (2 – 4 tests after identification)	Later Follow-up Testing After Blood Lead Level Declining
≥ 5 – 9	3 months *	6 – 9 months
10 – 19	1 – 3 months *	3 – 6 months
20 – 24	1 – 3 months *	1 – 3 months
25 – 44	2 weeks – 1 month	1 month
≥ 45	As soon as possible	As soon as possible

[a] Seasonal variation of BLLs exists and may be more apparent in colder climate areas. Greater exposure in the summer months may necessitate more frequent follow-ups.
* Some case managers or clinicians may choose to repeat blood lead tests on all new patients within a month to ensure that their BLL is not rising more quickly than anticipated.
Source: "Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention," Centers for Disease Control and Prevention (CDC), January 4, 2012

The National Center for Healthy Housing has a new tool (2013), *Childhood Lead Poisoning: What You Should Know about Your Child's Blood Lead Test Results*, which is very useful to share with parents. This factsheet explains how to interpret the child's blood lead test result and gives recommendations for action for an elevated blood lead level. On the reverse side of the factsheet is a comprehensive checklist that is intended for parents to understand what's expected when working with their child's health care provider and how to identify possible sources of lead in and around their home. The checklist includes questions regarding both paint and non-paint sources of lead.

Developing a Plan of Care

Based on the above assessments, the nurse case manager should develop a plan of care with the family that describes steps needed to lower the EBLL, prevent re-exposure and identify services needed to treat the lead poisoning. Areas the plan should cover include the following:

1. Reduction/elimination of environmental hazards
   - Assessment of all possible exposure sources.
   - Temporary/short-term hazard reduction (including temporary relocation to lead-safe housing if needed).
   - Long-term hazard elimination (including permanent relocation to lead-safe housing if needed).
   - Identification and removal of non-residential exposures.

2. Improvement of nutrition
   - Caregiver counseling.
   - Referral to WIC or other community food resources
3. Caregiver lead education
   - Counseling re: lead and lead-exposure risks, decreasing identified risks, importance of follow-up blood lead tests.
4. Medical follow-up care
   - Child with lead poisoning.
   - Siblings or other at-risk children living in home.
5. Follow-up of other identified problems
   - Counseling/referral for medical services, early intervention and developmental assessment, housing services, social services, Head Start, and parent support.

The case manager need not directly provide all follow-up care, but she/he is responsible for seeing that needed care is provided, including medical follow-up, and follow-up on referrals for other identified problems. Ongoing review and revision of the plan of care should be done with the family. When the plan of care is developed, the PHN should complete the Nursing Case Management Report (F-44771A; see Appendix A) and send it to WCLPPP.

Referrals to Community Resources

An important aspect of the case manager's role is making referrals. The case manager is responsible for connecting the family of a child with lead poisoning with services and resources that are available in the local community, or at the state or national level. The need for the following referrals should be considered:

- ✓ Ongoing source of health care if the child doesn't have a primary care provider.
- ✓ Agencies that can provide a thorough developmental evaluation and/or treatment if delays were noted on the screening test. These agencies may include Birth to Three, Early Head Start, Head Start or other early childhood programs.
- ✓ Nutrition counseling or WIC.
- ✓ Financial assistance from local housing or weatherization agencies for lead hazard reduction work on the property.
- ✓ Blood lead testing for pregnant women and other children <6 years of age in the household who share exposure to lead hazards.

The case manager's role is not limited to assisting with lead exposure prevention. It may also include helping families gain access to resources to address other issues.

If the child's medical provider is unfamiliar with treatment protocols, he/she can be referred to the Poison Center (1-800-222-1222) for consultation with a practitioner experienced in treating children with lead poisoning.

Coordinating Services

A diagnosis of lead poisoning in a child may plunge the family into a whirlwind of activity, worry, guilt, expense and frustration. The case manager can serve as an anchor during this experience, providing emotional support, assuring effective communication between those participating in the treatment of lead poisoning, and coordinating services for the family.

Supporting the Family

Families may need ongoing reassurance and support to help them meet the needs of their child with lead poisoning. Parents may feel guilt about having caused the lead poisoning because they were not aware of the dangers of lead before their child was exposed. They may also be uncertain as to what they can do to help their child.
The case manager should:

- Assess whether the family understands the diagnosis of lead poisoning and the implications that lead exposure may have on the child's learning abilities and behavior over time.
- Provide support to the parent/caretaker as they implement medical, environmental, and other interventions to treat the lead poisoning.
- Empower the family to assume responsibility for actions within their control to lower the child's BLL and enhance learning opportunities for the child.

Communication Among Multi-disciplinary Team Members

The case manager performs the role of prime communicator between the multiple professions that are providing services to the child and family. Several strategies are suggested to keep the entire team updated on the status of the child, the environment, and the family. Not only does this facilitate the work of all team members, but it keeps the child as the focus, preventing the services from becoming categorical or overlapping.

- ✓ Exchange information regularly with the child's primary health care provider. Make sure that he/she is aware that public health services are being provided to the child and family, and what those services include. Request information from the physician, such as the results of the physical assessment of the child.
- ✓ Convene case conferences on lead poisoned children being served by the LHD. Include the risk assessor, WIC nutritionist, early childhood program staff, social services, and any others that are providing services to the child and/or family. Discussion and problem solving should revolve around the outcomes defined by the plan of care, (medical, environmental, nursing, nutritional, developmental, educational, etc.), and any ongoing issues and concerns.

Evaluation of Care

The PHN should evaluate the plan of care on an ongoing basis and modify the plan as needed to assure progress toward the desired outcomes. This evaluation includes monitoring the child's health status and assuring that environmental interventions are completed in the shortest time possible to limit the child's exposure to lead.

Specific measures that can be used to evaluate progress include, but are not limited to, the following:

- The child's BLL is decreasing.
- The child is living in a lead-safe environment.
- The child is receiving supportive services for other identified medical conditions, developmental delays or behavior problems.
- The parent/caregiver has adequate knowledge of prevention and management of lead toxicity.

Case Closure

It often takes an extended period of time to achieve all elements of case management for lead poisoning. The child's case follow-up and the property investigation follow-up are two primary components of case management. The child's case record should not be closed until it is determined that the child lives in a lead-safe environment. This determination is made by the risk assessor/lead hazard investigator through a visual assessment and clearance testing (see Chapter 7). In some instances, the family may have moved out of the home where the initial lead exposure occurred and into a home where no lead hazards exist.

The WCLPPP has adopted the following *minimum* case closure criteria for an EBLL case:

- ✓ The child's BLL has remained <15 mcg/dL for at least six months.
- ✓ Lead hazards have been controlled or eliminated within the child's environment.
- ✓ There are no new lead exposures.

The PHN can also administratively close the child's case record when:

- ✓ The family moves and a referral has been made to the receiving LHD jurisdiction.
- ✓ The parent/caregiver refuses further public health intervention.
- ✓ The family moves and cannot be located.

After closing the child's case record, the PHN should complete the Nursing Case Closure Report (F-44771B; see Appendix A) and send it to WCLPPP.

References

Bellinger, D. C., Stiles, K. M., Needleman, H. L. (1992), Low level lead exposure, intelligence and academic achievement: A long term follow-up study. *Pediatrics*. 90(6);855-861.

Centers for Disease Control and Prevention (2012), CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in "Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention, *U.S. Department of Health and Human Services.*

Centers for Disease Control and Prevention (2012), Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, Report of the Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention, *U.S. Department of Health and Human Services.*

Centers for Disease Control and Prevention (2002), Managing Elevated Blood Lead Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention, *U.S. Department of Health and Human Services.*

Centers for Disease Control and Prevention (1991), Preventing Lead Poisoning in Young Children, *U.S. Department of Health and Human Services.*

Centers for Disease Control and Prevention (1997), *Screening Young Children for Lead Poisoning: Guidance for State and Local Public Health Officials, U.S. Department of Health and Human Services.*

Green, M. (Ed) (1994), Bright Futures: Guidelines for Health Supervision of Infants, Children and Adolescents, *National Center for Education*, Arlington, VA.

Mahaffey-Six, K. R., Goyer, R. A. (1972), The Influence of Iron Deficiency on Tissue Content and Toxicity of Ingested Lead in The Rat, *Journal of Laboratory and Clinical Medicine,* 79:128-136.

Reeves, S., Schmelzer, M., Vahldieck, R. (1989), A Framework for Planning Public Health Nursing Services to Families, *Public Health Nursing*, 6:102-107. Minor adaptations made by Bureau of Public Health: Schmelzer, M., Joosse-Coons, M., Musholt, M., LaFlash, S.

Chapter 7

Environmental Assessment and Intervention for a Child with Lead Poisoning

Contents

In Brief: Summary Recommendations for Assessment and Intervention of the Environment of a Child with Lead Poisoning 2

Introduction 4

When to Do an Elevated Blood Lead Investigation 5

Elevated Blood Lead Investigation Activities 7

Lead Hazard Reduction Activities 13

- Work Orders for Lead Hazard Reduction Should Address Priority Hazards 14
- Abatement Measures for Lead Hazard Reduction 15
- Non-abatement Measures for Lead Hazard Reduction 17
- Setting a Completion Date for Orders for Lead Hazard Reduction Activities 18
- Monitor Certification and Work in Progress 19
- Disposal of Lead-Contaminated Materials 19
- Clear the Property 19

Enforcement of Lead Hazard Reduction 21

Detailed and Current Information on Lead Hazard Reduction 22

Certification and Training of Lead Hazard Reduction Workers 23

Funding for Lead Hazard Reduction 23

References 25

Wisconsin Department of Health Services

(P-00660, 11/2014)

In Brief: Summary Recommendations for Assessment and Intervention of the Environment of a Child with Lead Poisoning

1. The major source of lead in Wisconsin children's environment is deteriorated lead-based paint (LBP). To protect children from lead exposure, it is necessary to evaluate and control their exposures to lead hazards, especially dust, soil and paint hazards.
2. Wis. Stat. 254.166(1) states that "If the department is notified that an occupant of a dwelling or premises who is a child under 6 years of age has an elevated blood lead level (EBLL), the department ***shall*** conduct a lead investigation of the dwelling or premises…"
3. Local health departments (LHDs) that contract with the Department of Health Services (DHS) to provide childhood lead poisoning prevention services are required to conduct investigations for all children with EBLLs. An EBLL is defined as one venous blood lead level (BLL) ≥20mcg/dL or two venous BLLs ≥15 mcg/dL drawn at least 90 days apart. An "EBL investigation" is described in Wis. Admin. Code DHS 163.03(39) as "environmental investigation activities conducted in response to a report of a lead poisoning and intended to identify lead hazards that may contribute to the lead poisoning." After conducting the investigation, LHDs must send a completed Property Investigation Report (F-44771C; also see Appendix A) to the Wisconsin Childhood Lead Poisoning Prevention Program (WCLPPP) and issue orders to owners to correct identified lead hazards.
4. While there is no requirement for LHDs to investigate homes of children with blood lead levels less than EBLL, LHDs ***may*** do so. LHDs can cite the Wis. Stat. 254.166 (1) as their authority to conduct environmental investigations for dwellings occupied by children with blood lead of 10 mcg/dl or more. LHDs may cite other laws such as Wis. Stat. 254.59 or 254.593 as their authority to conduct environmental investigations to evaluate lead hazards in other dwellings (such as where children have BLLs between 5 and 9 mcg/dl).
5. EBL investigations must be performed by certified risk assessors (RA) or certified lead hazard investigators (LHI). DHS describes the required work practices in Wis. Admin. Code DHS 163.14(6). Briefly summarized, RAs or LHIs must (1) examine painted or coated surfaces to identify any that are deteriorated and identify any other substances, surfaces or objects which by their location, condition or nature present hazards, then test these potential hazards for lead, (2) visually assess the exterior grounds to identify any bare soil and test bare soil for lead and (3) conduct dust wipe tests to evaluate potential lead dust hazards.
6. The RA/LHI must provide a written report of the findings of an EBL investigation to the property owner and tenant.
7. Under 254.166 (2m), if the RA/LHI finds lead hazards, the LHD ***shall*** issue an order describing the work needed to address the lead hazards, including a date when the work must be finished. If no lead hazards are found, the RA/LHI should conduct an EBL investigation in other places where the child spends a significant amount of time.
8. It is in the best interest of the child if the work to decrease lead hazards is accomplished quickly and is as long lasting as possible, given the resources available.
9. When the property owner reports that lead hazard reduction work is completed, the RA/LHI should conduct clearance including (a) visually clearing the dwelling to assure that the work to correct the hazards was done and (b) collecting dust wipe samples to assure that the dwelling is safe. Detailed work practice procedures for conducting clearance are described in Wis. Admin. Code DHS 163.14(5). Once the property meets both visual and dust wipe clearance standards, the RA/LHI must send a completed Property Investigation Closure Report (F-44771D; also see appendix A) to WCLPPP.

10. If clearance standards are not met, the RA/LHI shall inform the property owner and order further actions to correct the problems and set a deadline for completion.
11. If the property owner delays in completing orders within the time described in the orders, then the LHD should take more action. This may include posting a notice on the dwelling that lead hazards are present on the property; legal authority for this is in Wis. Stat. 254.166(2)(a). Other enforcement options are described in Wis. Stats. 254.59, 254.593 and 254.595. The LHD may also refer the case to the local legal counsel if there are relevant building codes, laws, or municipal ordinances. The LHD may also refer the case to the county district attorney as described in Wis. Stat. 254.30. (See Appendix B for a sample notice to the district attorney.) If the LHD declares the dwelling untenantable due to lead hazards, then Wisconsin landlord tenant law Wis. Stat. 704.07 may apply.

Introduction

The most effective treatment for lead poisoning is to remove the source(s) of exposure by eliminating or decreasing the lead hazards in the child's environment. Therefore, lead exposure is unlike other diseases for which medical treatments are effective; treating lead poisoning requires prompt action by public health, families, property owners and construction trades to reduce hazards from lead-based paint (LBP) and other lead-based coatings. Wis. Admin. Code DHS 163 and Wis. Stat. 254 provide the framework for the activities described in this chapter.

Lead hazard investigation activities means "any activity that determines whether LBP or lead hazards are present" [Wis. Admin. Code DHS 163.03(76)]. Elevated blood lead investigation means "the environmental investigation activities conducted in response to a report of a lead poisoning and intended to identify lead hazards that may contribute to the lead poisoning" [Wis. Admin. Code DHS 163.03(39)]. Lead risk assessments or lead hazard investigations are the appropriate methods to use when investigating dwellings of children with lead poisoning. To perform lead hazard investigation activities, an individual must be certified by the state as a lead risk assessor (RA) or lead hazard investigator (LHI).

Lead hazard reduction (LHR) activity is any action intended to permanently or temporarily reduce or eliminate human exposure to LBP hazards [Wis. Admin. Code DHS 163.03(71)]. Permanent actions such as removing all lead paint are called lead abatement activities, and must be performed by a certified lead abatement worker or supervisor. Temporary actions are non-abatement activities such as cleaning, re-painting or "stabilizing" lead painted surfaces so that the surface is clean, stable and intact. Non-abatement activities can be completed by a certified Lead-Safe Renovator.

The owner of the child-occupied dwelling, whether this is the child's parent/caregiver or a landlord, is responsible for fixing identified lead hazards to meet the clearance standards. Under state law, the RA/LHI shall use reasonable efforts to provide prior notice to the owner before investigating the dwelling or premises (property). The local tax assessor's office may assist the RA/LHI to identify and locate the property owner.

It is important to investigate the property where the child was lead poisoned, even if the child relocates. If an LHD finds lead hazards at a dwelling where a child lived when the lead poisoning was reported, the owner must correct these hazards, even if the family moves or the owner sells the property. If the family with a lead poisoned child moves, the RA/LHI should investigate the lead poisoned child's new residence to assure that the dwelling is in good condition and that lead hazards are not present. The new property may only require a visual assessment to determine age and condition, or it may require a full lead investigation (risk assessment or hazard investigation). If the RA/LHI does not find lead hazards at the primary residence of the child, then the RA/LHI should investigate secondary residences or other places where the child spends a significant amount of time.

The legal framework for environmental interventions for lead poisoned children and how to address human health hazards if a child has not yet been identified as lead poisoned is described in Wis. Stat. 254 (see 254.59 and 254.593). Lead poisoning is currently defined in statute as a BLL of 10 mcg/dL or more. Wis. Stat. 254.156 requires DHS to issue rules to correspond with the federal department of health and human services whenever that agency specifies a standard for determining lead poisoning or lead exposure that differs from Wis. Stat. 254.11. In May 2012, the federal Centers for Disease Control and Prevention defined a new "reference value" of five mcg/dl and abandoned the use of the previous term "lead poisoning,"

which meant a blood lead level of 10 mcg/dl or more. Through this action, the CDC indicated that children with blood lead levels ≥5 mcg/dL will benefit from environmental investigations and interventions that result in reduced exposure to lead hazards.

Details of certification and work practice standards are defined by Wis. Admin. Code DHS 163. Questions about certification issues should be addressed to the Wisconsin Asbestos and Lead Section, by phone at 608-261-6876; or by email to dhsasbestoslead@wisconsin.gov or by fax at 608-266-9711.

When to Do an Elevated Blood Lead Investigation

Wisconsin law (Wis. Stat. 254.166) requires intervention when a child's blood lead level (BLL) reaches an "elevated blood lead level (EBLL)." The statutory definition of an EBLL is a venous BLL ≥20 mcg/dL or two venous BLLs ≥15 mcg/dL drawn at least 90 days apart. Local health departments are *required* to do environmental investigations for EBL children.

- ✓ Wisconsin law states that DHS "*shall* conduct a lead investigation of the dwelling or premises or ensure that a lead investigation of the dwelling or premises is conducted" for all children less than 6 years of age with an EBLL [Wis. Stat. 254.166(1)].
- ✓ Local health departments (LHDs) under contract with DHS must comply with Wisconsin Statute by providing a lead hazard investigation for all children with an EBLL.

The CDC-recommended timeframe for environmental investigation based on the child's blood lead level is in Table 7.1.

Table 7.1 CDC-Recommended Timeframe for Environmental Investigation According to a Child's Blood Lead Level

Blood Lead Level (mcg/dL)	Timeframe for Environmental Investigation
10 – 14	Within 30 days
15 – 19	Within 2 weeks
20 – 44	Within 1 week
45 – 70	Within 48 hours
70 or Higher	Within 24 hours

The Wisconsin Medicaid Program will reimburse LHDs for an environmental inspection of a lead poisoned or lead exposed child's home and a follow-up inspection to determine clearance of the property after work has been done if the child is enrolled in Medicaid. (See Chapter 12 for detailed information about the Medicaid reimbursement process.)

LHDs *may* do environmental investigations for children with lower blood lead levels. Wisconsin law (Wis. Stat. 254.166) supports action to prevent lead hazards for children with lower blood lead levels (lead poisoning or lead exposure is a BLL ≥10 mcg/dL). The department "*may*" conduct an investigation in these cases. Wis. Stat. 254.166(1) permits an inspection of the dwelling of any child under 6 years of age with a BLL ≥10 mcg/dL.

Furthermore, Wis. Stat. 254.59 states that local health officers who find human health hazards shall order the abatement or removal of the human health hazard. Wis. Stat. 254.59(4) also specifically permits local health officers, in cities under general charter, to enter a dwelling to ascertain health conditions at any place or at any time. Wis. Stat. 254.593 declares housing that is dilapidated, unsafe or unsanitary to be a human health hazard. LHDs have broad authority to address human health hazards. Wis. Stat. 254.595 establishes the authority for municipal building codes and allowing municipalities to declare properties with lead hazards to be a nuisance. Cities, towns or villages may issue orders or regulations and may commence an action to declare a property to be a human health hazard.

There is widespread consensus that BLLs below 10 mcg/dL have negative cognitive, behavioral and lifelong health effects on children. The Center for Disease Control and Prevention (CDC) acknowledged this in 2012 when they established 5 mcg/dl as the new "reference value." Although CDC has urged that homes be evaluated for lead hazards before children are known to be exposed, the CDC also indicates that an investigation should be conducted to identify sources of lead in the homes and environments of children with venous BLLs ≥ 5 mcg/dL. CDC stated that this reference level may change in the future. Currently 97.5 percent of children in the U.S. aged 1-5 years have BLLs less than 5 mcg/dL. Because no level of lead in the body is safe, CDC will continue to monitor population BLLs and, using the 97.5 percent indicator, may further reduce the reference value should population-based national surveys (such as NHANES) show that U.S. children's BLLs continue to decline.

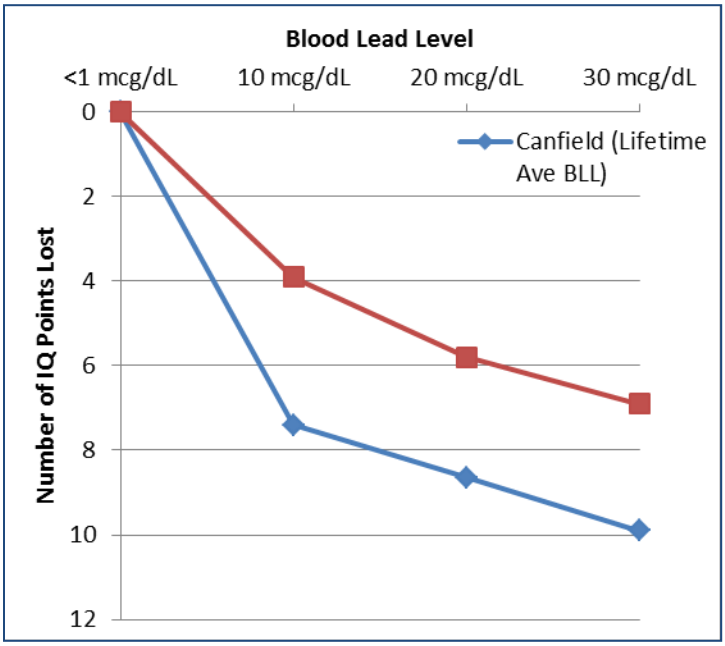


Figure 7.1. Lost IQ points as BLL rises.

There is strong evidence that the damage that happens as a child's blood lead rises from 0 to 9 mcg/dL is more severe than the changes that occur as a child's blood lead rises from 10 to 19 mcg/dL (see Figure 7.1, (Canfield et al., 2003; Lanphear et al., 2005; Jusko et al., 2008). These are compelling reasons for LHDs to do whatever they can to protect children from lead exposure.

Many LHD policies in Wisconsin support the CDC recommendations as a best practice since they have set goals to provide services for families with children whose BLL is ≥5 mcg/dL. At this time, due to limited resources most LHDs cannot investigate all dwellings occupied by children with BLLs ≥ 5 mcg/dL and thus cannot meet the standard of care that CDC has recommended. It is the goal of WCLPPP to encourage best practice. Therefore WCLPPP encourages LHDs to seek the resources necessary to investigate homes of children with BLLs ≥5 mcg/dL, to identify and evaluate potential lead hazards and to encourage families and property owners to correct these conditions safely and quickly.

Elevated Blood Lead Investigation Activities

Stopping the exposure of a child to lead hazards is the most important treatment for lead poisoning. Other interventions, such as nutritional support and treatment of anemia may help to reduce lead absorption and can be monitored by the child's health care provider. Assessment of the environment is the first step in identifying the source(s) of lead exposure and activities to control or eliminate the exposure. The EBL investigation has six major components: (1) pre-investigation preparation, (2) interview, (3) visual assessment to determine the locations of deteriorated paint and lead paint hazards, (4) collection of samples to measure lead in the environment, (5) identifying and evaluating non-paint lead hazards, and (6) written report to the property owner and tenant. These are covered in detail in certification training and in administrative rules and will be summarized briefly here and in Table 7.1.

Table 7.2 Summary Steps of an Elevated Blood Lead Property Investigation

EBL Investigation Activities	Detailed Description of Activities
Pre-Investigation Activities	Review lead-based paint hazards and data collection forms.
Interview	From the tenant and property owner, collect background information about the age, physical characteristics, and use patterns of the dwelling, to identify non-paint lead hazards.
Look at the property	Do a visual assessment to evaluate (a) the condition of painted and varnished surfaces, (b) the extent and causes of any deteriorated coatings, and (c) identify other potential lead hazards. Sketch the floor plans. Take photographs to show all exterior views and any obvious hazards or deteriorated coatings.
Collect environmental samples and send to the Wisconsin State Laboratory of Hygiene for analysis	Conduct a lead risk assessment using procedures described in Wis. Admin. Code DHS 163.1; collect dust wipes in areas where children are likely to come into contact with dust; collect paint or varnish chips to identify lead in coatings; collect soil samples where soil is bare. Typically RAs and LHIs take at least eight wipe samples (from four floors and four window sills). In multi-family dwellings, also collect samples from common areas where children are likely to be exposed.
Identify non-paint hazards	Determine if non-paint lead hazards may be causing exposure and conduct testing as needed to evaluate exposure. Consult the Wisconsin State Laboratory of Hygiene to clarify how to collect and submit unusual environmental samples for analysis.
Write a summary report and work orders for LHR	When lab analyses are completed, write a summary report of the lead hazard investigation, including the results of the property investigation and work orders for LHR. Specify in the work orders what work needs to be done, the certification needed for those who will do the work, the due date for completing the work, and the owner's rights to appeal the order. If work ordered by LHDs to reduce lead hazards is considered abatement, it must be performed by a state certified lead abatement contractor. If the work involves temporary measures such as cleaning and stabilizing lead hazards, the work may be done by a state certified lead safe renovator or a lead abatement contractor.

EBL Investigation Activities	Detailed Description of Activities
Deliver report and work orders to the property owner and tenant	Provide copies to the property owner and tenant family.
Submit Property Investigation Report (F-44771C)	Complete the form with the results of the summary report and submit to the WCLPPP.
Monitor the LHR work that is ordered	If staff resources are available, monitor the work in progress to assure the contractors are trained and certified and that they follow correct lead-safe work practices.
Clear the property through visual assessment and clearance dust wipe samples **Determine that non-paint hazards have been removed or addressed.**	Conduct a follow-up visual assessment to determine that lead hazards have been remediated and non-paint hazards have been removed. For interior lead-based paint hazards, collect clearance dust wipe samples to verify safe completion of the work ordered. See Table 7.6 for guidance on sample collection for clearance.
Submit Property Investigation Closure Report (F-44771D)	If clearance is achieved, complete and submit the property closure report to WCLPPP.
Enforcement Activities	Detailed Description of Activities
Initiate Enforcement Actions	If the property owner does not comply with LHR orders, the LHD should take action. For example, the LHD may placard the dwelling as described in Wis. Stat. 254.166(2)(a). Other enforcement options are described in Wis. Stat. 254.59, 254.593 and 254.595. The LHD should refer enforcement cases to the County District Attorney as described in Wis. Stat. 254.30 or to another local legal authority for enforcement.

(1) Pre-investigation Preparation – Before visiting a dwelling to evaluate the sources of lead in a child's environment, it may be helpful for the investigator to review some images showing causes of paint failure, such as those in HUD's online Visual Assessment Training.

Chttp://www.hud.gov/searchauses of paint failure include moisture, aging, temperature extremes, sunlight, mechanical damage (such as impact or friction), chemical incompatibility, poor surface preparation, and damage to the substrate. These causes should be noted during the investigation, and correcting the underlying causes of paint failure should be included as part of the LHR orders.

It may also be useful to review and print HUD's suggested forms for recording the data collected during the investigation. See the HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (2012 Edition) for the following forms:

Form 5.0 Resident Questionnaire
Form 5.1 Building Condition Form
Form 5.2 Report of Visual Assessment
Form 5.3 Paint Chip Sampling
Form 5.4 Dust Sampling

Form 5.5 Soil Sampling
Form 5.6 Management Data for Rental Dwellings
Form 5.7 Maintenance Data for Rental Dwellings

(2) Interview the Family and Property Owner – An interview with the family of the lead poisoned child is the first step in identifying sources of lead exposure. This part of the property investigation is vital to determine the child's habits and locations the child frequents, both in and outside of the home. It is also the time when questions can be asked about non-LBP hazards and exposures and other properties the child visits frequently. The RA/LHI should conduct the interview using HUD Form 16.1 "Resident Questionnaire for Investigation of Children with Elevated Blood Lead Levels." See 2012 HUD Guidelines Forms. It is helpful if the RA/LHI can interview the property owner about the history and uses of the property. It also allows the RA/LHI to provide information to the owner about lead poisoning, including any preliminary findings from the EBL investigation, lead-safe maintenance practices, and the owner's legal responsibilities.

(3) Visual Assessment – A visual assessment quickly identifies deteriorated surface coatings, the most widespread and dangerous sources of lead in the environments of children. Whether a lead-based surface coating becomes a hazard depends on several factors:

- ✓ The condition of the paint or coating;
- ✓ The location, such as on friction or impact surfaces;
- ✓ The concentration (parts per million) or loading (milligrams per square centimeter as measured by XRF or micrograms per square foot as measured by dust wipes) of lead in the paint or coating; and
- ✓ The accessibility of the paint or coated surface to children.

If lead is present in paint or other surface coatings that are intact (i.e., in good condition and not chalking, cracking, chipping, peeling, flaking), the lead may not present a hazard and should not be disturbed. However, if LBP is "present in accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects," then these coatings meet the definition of a lead-based paint hazard. Table 7.2 provides definitions and examples for friction, impact and accessible surfaces. RAs/LHIs should exercise judgment and consider background information such as environmental lead dust sampling data, building history, component location and occupant use patterns to determine if intact coatings on surfaces listed in Table 7.3 require treatment to protect occupants from lead exposure.

Bathtubs

Note that the 2012 HUD Guidelines omitted a question about deteriorated surfaces on bathtubs that was included in the earlier (1995-2011) version of the Guidelines. Based on experience in Wisconsin, it is appropriate to consider bathtubs as a source of lead exposure, so DHS recommends including the question from the original version of the Guidelines: "Does the child take baths in an old bathtub with deteriorated or nonexistent glazing?"

DHS also encourages RAs/LHIs to evaluate potential lead dust hazards by taking dust wipe samples from glazing on older bathtubs. Although HUD has stated that the lead coatings on tubs does not meet HUD's interpretation of LBP coatings because of the way the lead coating was originally applied to the substrate, the lead dust that is generated when lead on bathtub glazing deteriorates can cause lead exposures that can harm children regardless of the application method.

In Wisconsin, RAs/LHIs from LHDs in Dane and Washington counties have documented two cases of children whose primary source of lead exposure was deteriorated lead coatings on bathtubs.

Table 7.3 Definition and Examples of Friction, Impact and Accessible Surfaces

Definition	Examples in the home
Friction Surfaces: ". . . an interior or exterior surface that is subject to abrasion or friction. . ."	✓ Door systems where painted parts rub against other surfaces ✓ Window sashes and jambs ✓ Floors or stairs, especially in high traffic areas, such as entrance areas and hallways ✓ Cabinet drawers and their openings ✓ Pantry shelf surfaces where food containers or dishes may scrape the shelves
Impact Surfaces: ". . . an interior or exterior surface that is subject to damage by repeated impacts . . "	✓ Doors, doorknobs and latches that strike door stops, walls or strike plates ✓ Cabinet doors that strike cabinets or walls ✓ Drawers that contain sharp objects (such as knives or tools) ✓ Baseboards that may be struck by objects such as vacuum cleaners, boots, shoes or riding toys ✓ Stair risers and stair stringers that may be struck by the toe/tip of shoes
Accessible Surfaces: "… an interior or exterior surface painted with lead-based paint that is accessible for a young child to mouth or chew."	Window sills Porch railings Stair railings and balusters Furniture

Source: Residential LBP Hazard Reduction Act of 1992, Public Law 102-550, Section 1004, Definitions (2)

(4) Collect Environmental Samples

Lead in coatings: Two methods are available for measuring LBP on coatings: (1) test onsite with an X-ray fluorescence (XRF) instrument; or (2) collect samples for a laboratory to analyze off-site. The XRF instrument measures the lead loading (lead per area) in the coat of paint or varnish while laboratories typically report concentration values or lead by weight.

Many private RAs/LHIs collect paint chips or varnish samples and send these to private laboratories that analyze environmental lead samples and have been recognized by the Environmental Protection Agency (EPA) as having the capacity to do these tests through the National Lead Laboratory Accreditation Program. Wisconsin LHDs can use the Wisconsin State Laboratory of Hygiene (WSLH) Occupational Health Laboratory to analyze these samples from homes of lead-exposed children. A sample of the form used to submit environmental samples to the WSLH can be found In Appendix A.

Another method is to use XRF instruments to measure lead loading on coated surfaces. The WCLPPP staff maintains XRF instruments that certified RAs can use to investigate dwellings where lead-exposed children reside. To borrow these instruments, the RA must have

appropriate training and up-to-date certification credentials. Under the terms of the DHS radioactive materials license, all XRF instrument users must also have U.S. Department of Transportation hazardous materials training.

The specific procedures for how to test paint or varnish by collecting samples for lab analysis or with an XRF instrument are covered in the RA/LHI and Lead Inspector training and are not described in detail in this handbook. These procedures are also summarized in the 2012 HUD Guidelines. The condition, location and accessibility of potential lead hazards can be evaluated visually. Measuring lead on coatings requires testing as described above. Other surfaces or substances may also need to be tested to evaluate potential lead exposure sources in the child's environment.

Home test kits indicate the presence of lead by showing a color change, but they do not quantify the amount or the concentration of lead. They can be used on many products, including paint, pottery, and mini-blinds.

Lead in dust: In all cases, the RA/LHI shall take dust wipe samples to measure the lead that is present in surface dust on floors and window surfaces. Wis. Admin. Code DHS 163.14(9) states that the risk assessor shall take wipe samples from each floor and each window sill where a child under the age of six is likely to come into contact with dust, and from common areas in the building where the risk assessor determines that a child under age six is likely to come into contact with dust. Practically speaking, risk assessors typically take floor and window sill wipe samples from a minimum of four rooms such as the main entrance areas to the dwelling, play areas such as living rooms, and the kitchen and bedrooms. The RA/LHI may also take wipe samples to evaluate lead dust on other non-conventional surfaces such as painted toys or bathtubs. If an RA/LHI is concerned about a parent or guardians' potential to bring home lead dust from exposure to lead at work, the RA/LHI may take wipe samples from sources such as work shoes, clothing, tools or vehicles.

The benefits and drawbacks of different ways to measure lead on coatings and different sampling methods are covered in the training required for certification in a profession that can perform a lead hazard investigation. In general, XRF instruments are useful in that they produce results quickly and non-destructively. However, taking samples for laboratory analysis may provide more sensitive measures of lead in the environment.

(5) Assess for Non-paint Lead Hazards – While painted surfaces introduce the most lead into an average child's environment, other potential sources of lead exposure should also be assessed. As RA/LHI investigate dwellings associated with increasingly lower blood lead levels, it is likely that they will identify more exposure sources (Levin et al, 2008). These include parental occupations or hobbies, pottery, traditional medicines or cosmetics, candies, chalk, toys, vinyl mini or vertical blinds, candles, and pool chalk. (See Chapter 3 for more details on lead sources.) New sources of lead continue to emerge. Staff at the WSLH can usually provide advice on how to collect valid samples for testing unusual sources.

The WCLPPP attempts to notify all LHDs of newly identified sources of lead. Another useful resource to check for products recalled due to containing dangerous levels of lead is www.saferproducts.gov (click on the search tab and see the lower right-hand corner for products containing lead). The National Center for Healthy Housing sends notifications of newly identified lead sources through their Lead and Healthy Homes email listservs. (Send a blank message to Leadnet-on@mail-list.com or Healthyhomesnet-on@mail-list.com to subscribe.)

These email listservs are also good sources of information on current legislation, litigation, and other program activities aimed at eliminating lead hazards throughout the U.S.

(6) Written Report to Property Owner and Tenant – The RA/LHI must provide a written report summarizing the risk assessment/lead hazard investigation to the owner and tenant within 10 working days after the assessment or when results of laboratory samples are received. The content of the written report is described by Wis. Admin. Code DHS 163.14(9)(k) and DHS 163.14(6) to include:

- ✓ Date of risk assessment (or lead hazard investigation);
- ✓ Address of each building assessed;
- ✓ Date of construction of buildings;
- ✓ Apartment number of units assessed, if applicable;
- ✓ Name, address and telephone number of each current owner of each building;
- ✓ Name, address, telephone number, certification number and signature of each certified individual participating in the risk assessment/lead hazard investigation;
- ✓ Name, address, telephone number and certification number of the certified lead company conducting the risk assessment/lead hazard investigation;
- ✓ Name, address, and telephone number of each recognized laboratory conducting analysis of collected samples;
- ✓ Results of the visual inspection;
- ✓ Description of testing method and sampling procedure used for paint analysis;
- ✓ Specific locations of each painted component tested for the presence of lead;
- ✓ All data collected from onsite testing, including quality control data and, if used, the serial number of any XRF;
- ✓ All results of laboratory analysis on collected paint, soil and dust samples;
- ✓ Any other sampling results;
- ✓ Any background information on the physical characteristics of the residential dwelling or child-occupied facility and occupant use patterns that may cause LBP exposure to a child under 6 years of age;
- ✓ If used, the results of any previous inspections or analyses for the presence of LBP hazards or other assessment of LBP-related hazards;
- ✓ A description of the location, type and severity of identified LBP hazards and any other potential lead hazards; and
- ✓ A description of LHR options for each identified LBP hazard and a suggested prioritization for addressing each hazard. If the use of an encapsulant or enclosure is recommended, the report shall recommend a maintenance and monitoring schedule for the encapsulant or enclosure.

LHR work orders from LHDs to property owners must specify the level of training and certification that is required for those who will do the work, and the date when the work must be completed.

To facilitate writing the risk assessment/lead hazard investigation report, the RA/LHI should collect and record the field data in a systematic fashion to keep the EBL investigation organized and thorough. Careful data collection helps to document findings and to communicate clearly with property owners and occupants. Several tools to be used for data collection can be found in Appendix C: Samples. The 2012 HUD Guidelines also provide examples of forms that can be used for this purpose. Investigators can use or adapt any data collection form or tool as long as they meet the requirements of Wis. Admin. Code DHS 163. Examples of a risk assessment report and a work order are also shown in Appendix B.

Under Wisconsin Law, reports of investigations conducted in response to a child with lead poisoning shall be made available to the public and therefore should be written to withstand public scrutiny. The DHS and LHDs acting under the authority of the Department "shall prepare and file written reports of all risk assessments conducted under this section and shall make the contents of these reports available for inspection by the public, except for medical information..." [Wis. Stat. 254.166(1)].

Property owners must provide these reports to future tenants and buyers under U.S. federal law governing real estate transactions. This requirement is regulated and enforced by HUD and EPA. To comply with federal law, the report to the owner should include the following paragraph:

> *The federal Residential Lead-Based Paint Hazard Reduction Act, 42 U.S.C. 4852d, requires sellers and landlords of most residential housing built before 1978 to disclose all available records and reports concerning lead-based paint and/or lead-based paint (LBP) hazards, including the test results contained in this notice, to purchasers and tenants at the time of sale or lease or upon lease renewal. This disclosure must occur even if hazard reduction or abatement has been completed. Failure to disclose these test results is a violation of the U.S. Department of Housing and Urban Development and the U.S. Environmental Protection Agency regulations at 24 CFR Part 35 and 40 CFR Part 745 and can result in a fine of up to $11,000 per violation. To find out more information about your obligations under federal LBP requirements, call 1-800-424-5323.*

A sample letter written to a property owner to summarize a lead risk assessment/hazard investigation in the case of a lead poisoned child can also be found in the Appendix B.
LHD staff must report risk assessments/lead hazard investigations of the residence(s) of children with EBLLs to WCLPPP on the Property Investigation Report (F-44771C; see Appendix A). This information allows program staff to conduct surveillance of causes of childhood lead poisoning and to effectively target resources to assist in education, environmental investigations and primary prevention activities.

Lead Hazard Reduction Activities

An important role of the RA/LHI is to assure that property owners address the identified lead hazards that threaten children's health. The RA/LHI working for an LHD typically writes orders that direct owners' actions and should, if possible, also refer property owners to agencies that offer financial assistance (loans or grants) to support the cost of the LHR work. (See the section in this chapter on funding for LHR for suggestions, page 7.21.) The RA/LHI should monitor the LHR work and must document that the hazards have been successfully treated (see Table 7.1).

The RA/LHI can exercise professional discretion in choosing whether to order abatement or interim control activities, and in setting the amount of time allowed for the owner to complete the orders and fix the hazards. The state law, Chapter 254.166(2m), describes several different timelines depending on the severity of the hazard and acknowledging the difficulty of completing exterior work in winter. The RA/LHI's goal is to get the owner to fix the lead hazards quickly, and permanently if possible, and thus protect children from lead exposure.

Analysis of Wisconsin data of children with diagnostic BLLs between 20 and 40 mcg/dL has shown that it takes about 2.2 years for the BLL to drop below 10 mcg/dL. Another Wisconsin study found that it took most property owners 465 days (median value) to correct lead hazards in dwellings where children were identified with an elevated blood lead (Zierold et al., 2007). Additional analysis found a faster decline in the child's BLL when the LHR on the property was completed within six months. Based on these data, it is important to set realistic expectations for work to reduce lead hazards that can be accomplished quickly.

Work Orders for Lead Hazard Reduction Should Address Priority Hazards – LHR should be prioritized to most effectively decrease exposure to children. Since there is more lead on exterior surfaces than interior surfaces in US homes (Jacobs, et al, 2002), it is especially important to address exterior lead paint hazards. Variations in children's blood lead levels often reflect their exposure to exterior hazards. So for example, children's blood lead levels generally increase in summer when exposure to exterior sources increase (Levin, Brown, et al. 2008). Children's blood lead levels decrease when exterior hazards are corrected. Children living in homes where exterior lead hazards have been addressed showed lower blood lead after a year than children without these exterior interventions (Clark, Galke, et al., 2011).
Priority should be given to areas where children play, eat, and sleep. Where lead paint or varnish has been documented, priority attention should be given to areas that present a high risk of exposure:

- Floors, stairs and porches that have deteriorated coatings (such as visible paint chips), or are located in areas where active disturbance of the paint or varnish has occurred and the disturbed coatings have fallen and accumulated;
- Windows that have visible paint chips, dust or glazing debris accumulating on the stool or in the trough;
- Deteriorated exterior surfaces likely to contribute to children's exposure; (Note that there is more lead paint on the exterior surfaces of a typical house than on the interior surfaces. Note also that exterior painted surfaces are subject to greater weather variability extremes of temperature and moisture.)
- Exterior child play areas with bare soil contaminated with visible paint chips;
- Toys, beds, and other furniture in the child's usual activity areas.

RA/LHI can exercise considerable discretion as they describe work methods for the owner to use to address the lead hazards. Lead hazards can be controlled temporarily, through interim controls, or permanently, through abatement. The RA/LHI can exercise his/her judgment about which hazard reduction measures are best suited for a given situation. Any LHR work, whether interim controls or abatement, can create exposure hazards if the person doing the work is not properly trained, if dust created during work is not minimized, or if proper clean-up of lead dust and debris is not done. Depending on the hazards found and the type of work to be done, the occupants may need to be relocated until the hazards are controlled.

Abatement Measures for Lead Hazard Reduction – While permanent measures (abatement) tend to be costly, they do produce long-term safety for children and greater liability protection for the property owner. Abatement means "any measure or set of measures intended to permanently eliminate LBP hazards" [Wis. Admin. Code DHS 163.03(1)]. The four types of abatement techniques commonly used are encapsulation, enclosure, removal, and replacement. The definition and application of each is fully described in Table 7.4.

Table 7.4. Lead-Based Paint Abatement Techniques

Method/Definition	Description	Application
Encapsulation ". . . the process of making LBP inaccessible by the application of an encapsulant." DHS 163.03(42)	Provides a barrier between LBP and the environment.	A barrier, formed by applying a liquid coating or adhesive bond specifically labeled as an encapsulant, is used to cover LBP. The area to be treated is first tested to determine if the encapsulant will hold to the surface. Not for use on friction or impact surfaces. When complete, encapsulation should leave an easy-to-clean surface.
Enclosure ". . . the use of rigid, durable materials . . . that act as a dust-tight barrier between LBP and the environment." DHS 163.03(44)	A barrier is attached to building components with all edges and seams sealed. Examples are sheet rock, wood or wood paneling on walls, exterior siding, vinyl/metal sash tracks for windows, linoleum, or wood over floors.	The enclosed area must be able to support the added weight of the enclosure material. Enclosure material is nailed or screwed into wood rafters or studs; caulk or some type of sealant is applied to the back of the surface to create an airtight barrier to lead dust. When complete, enclosure should leave an easy-to-clean surface.
Removal	The removal of all LBP from building components. Can be done on- or off-site. Removal can be conducted on the entire surface or just at the friction points where LBP rubs together.	The following methods **cannot** be used for onsite removal: [DHS 163.14(3) and (4)]: ✓ Open flame burning or torching ✓ Machine sanding or grinding, abrasive blasting or sandblasting, or planing **unless** contained and a HEPA attachment is used. ✓ Uncontained high pressure water blasting or "hydroblasting." ✓ Paint strippers containing methylene chloride. ✓ A heat gun at $\geq$ 1100°F. ✓ Dry scraping <u>except</u> around electrical outlets or on spots totaling no more than 2 square feet in any one interior space or 20 square feet on exterior surfaces. When complete, removal should leave an easy-to-clean surface.
Replacement ". . . removing building components that have surfaces coated with LBP and installing new components free of LBP. DHS 163.03(101)	The building component contaminated with LBP is replaced with a new component.	Cost effective for wood trim (baseboards), replacing doors and windows with energy efficient ones. When complete, replacement should leave an easy-to-clean surface.

Data indicate that permanent measures are more effective at reducing lead dust levels and protecting children than temporary measures (Wilson J, et al., Dixon SL, et al., 2007; Dixon SL, et al., 2012). However, studies that demonstrated greater effectiveness of permanent interventions, such as replacing components (windows and doors) and installing siding, in comparison to temporary measures such as re-painting, were funded with federal grants. When such funding is not available, property owners often find less expensive temporary options more attractive. If permanent measures are too expensive for a given situation, it is appropriate to write orders for temporary measures. Children benefit from rapid control of lead hazards. It is appropriate to write orders that are achievable and that match the resources available to the property owners. (See Table 7.5 for the differences between lead-safe renovation and lead abatement activities.)The studies listed above provide good recent evaluations of what methods work to reduce lead hazards in housing. Earlier studies offer some useful historical evidence. For earlier reviews on evaluating lead hazard control measures, see: Does Residential Lead-Based Paint Hazard Control Work? A Review of the Scientific Evidence (National Center for Lead-Safe Housing, 1995); and Review of the Studies Addressing Lead Abatement Effectiveness (EPA, 1998).

Table 7.5 Lead-safe renovation activities versus lead abatement

Issue	Lead-Safe Renovation Activities	Lead Abatement
Who may conduct	• Certified Lead Safe Renovator (LSR) • Certified Lead Abatement Supervisor • Certified Lead Abatement Worker • Employees trained and supervised by a certified renovator, etc. • Must be affiliated with a Certified Lead-Safe Company or Lead Company	• Certified Lead Abatement Supervisor • Certified Lead Abatement Worker • All must be affiliated with a certified Lead Company
Certification card	Must have card ***on site*** when at renovation project site	Must have card ***on site*** at all times
Project Notification	***Not*** required	Required
Information to occupants/owners	Distribute the "Renovate Right" pamphlet to owners and occupants	Prepare and post an occupant protection plan
Work methods	Follow documented lead-safe methodologies	Follow documented abatement methodologies
Responsibilities of a certified person	Certified Lead-Safe Renovator: • Provides on the job training to untrained workers • Must be on site to ensure signs posted and work area contained • Must be on site during final cleaning • Must conduct the final Cleaning Verification protocol LSR is ***not*** required to be on site all other times during renovation	Certified Supervisor: • Must provide ***direct*** onsite supervision to certified workers at all times during abatement work, from containment set- up to final cleaning • Ensures proper containment, work practices and cleaning methods are used

Issue	Lead-Safe Renovation Activities	Lead Abatement
Containment	Interior: Minimum 6 feet Exterior: Minimum 10 feet Containment must prevent distribution of dust and debris outside of the ***renovation*** work area	Containment of work area. Must prevent the distribution of dust and debris outside of the ***abatement*** area
Protect property	Must protect personal property	**Must protect personal property**
Restrict access	Restrict access to renovation areas	Restrict access to abatement areas
Cleaning/final cleaning	Clean work area each day and at the end of the project LSR is on site to ensure proper cleaning	Clean work area each day and at the end of the project Certified supervisor on site
Visual inspection	LSR conducts visual inspection of work area (interior and exterior) to ensure all dust and debris have been removed	Certified supervisor conducts visual inspection of work area (interior and exterior) to ensure all dust and debris have been removed
Cleaning verification/ Clearance	LSR personally conducts the final Cleaning Verification protocol	Certified supervisor arranges for post-abatement clearance to be conducted by a certified lead inspector, hazard investigator or risk assessor
Report	Provides written report to the owner and person contracting for the renovation within 10 days after completion of renovation project	Provides written report to person contracting for abatement within 10 days after receiving clearance report, but no later than 20 days following completion of the abatement project

Non-abatement Measures for Lead Hazard Reduction – Non-abatement activities are "any measures or activities intended to temporarily but not permanently reduce exposure to LBP hazards" [Wis. Admin. Code DHS 163.03(c)]. Cleaning, wet scraping and repainting can be economical and cost-effective for some interior or exterior wall surfaces. Cleaning can inexpensively and rapidly reduce lead dust levels, but lead hazards addressed by cleaning only have failed dust tests more often and more quickly than surfaces treated by more thorough methods. Cleaning alone does not address the source(s) of the lead dust hazards.

Examples of temporary measures that parents and property owners can take quickly to clean and control access to hazards are listed below.

- ✓ Wash pacifiers and toys that are mouthed frequently during the day;
- ✓ Block access to areas where paint is not intact (e.g., with heavy pieces of furniture);
- ✓ Wet-clean window sills and window wells at least twice a week using soap and water;
- ✓ Wet mop all floors with soap and water at least twice a week and as needed; and
- ✓ Use a vacuum with a HEPA filter to clean areas of paint dust and chips.

These temporary measures are most effective when the area is well circumscribed, such as a window well, a porch, floors, etc., but they are not a substitute for long-term or permanent LHR.

Interim controls, such as cleaning and re-painting, require continuous and frequent monitoring because it is unclear how long they will effectively control lead hazards. They offer limited long-term protection for current or future occupants. Whenever possible, LHDs are advised to order cleaning only for immediate and very short-term efforts to reduce lead exposure. LHDs should require work that is more protective than cleaning. For example, LHDs can order stabilization (cleaning, preparing the surfaces for re-painting) for some limited temporary control of lead hazards. Limited wet scraping and wet sanding may be considered interim control methods if the goal is to prepare surfaces for re-painting and to stabilize and make intact those surfaces coated with old lead paint rather than the permanent removal of LBP.

LHDs can also order more long-term permanent abatement measures for sustained LHR at the property. For building components subject to friction and impact (Table 7.3), permanent (abatement) measures are more cost effective than interim controls at reducing lead dust levels long term. If orders allow the owner to conduct non-abatement work such as painting, the LHD should emphasize to the owner that the dwelling must pass wipe tests to ensure that the property meets clearance dust standards. (See Table 7.5 for the differences between lead-safe renovation activities and lead abatement.) This independent third party testing to achieve numerical lead dust standards is more strict (and more protective to occupants) than the "visual clearance tests" that contractors do for their other lead-safe renovation work.

Setting a Completion Date for Orders for Lead Hazard Reduction Activities – Wisconsin law [Wis. Stat. 254.166(2m)] provides LHDs guidance in setting time limits for property owners to conduct this work (Table 7.6). LHDs shall issue orders (to the owner) to reduce or eliminate imminent hazards within five days. For non-imminent lead hazards, LHDs shall order owners to reduce or eliminate lead hazards within 30 days of the order's issuance. For orders issued to address non-imminent hazards on the exterior of the dwelling during the cold weather period of October 1 to May 1, orders may require a deadline of no earlier than June 1 immediately following the order's issuance. LHDs can extend the time period to comply with the orders if the agency determines that the property owner has good cause for not complying.

Table 7.6 Deadlines for Ordering Lead Hazard Reduction

Type of hazard	**Time Limit**
Imminent hazards [Defined in Wis. Stat. 254.11(7g)]	5 days
Non-imminent hazards	30 days
Non-imminent exterior hazards found October 1 through May 1	After the next June 1

Source: Wis. Stat. 254.166(2m)

State law uses two different verbs ("will" and "may") to define imminent lead hazards and lead hazards. *An imminent lead hazard* **will** *place a child under six years of age at risk of developing* lead poisoning or lead exposure while *lead hazards* **may** *contribute* to lead poisoning or lead exposure of a child under six years of age. From a practical perspective, if an EBL investigation finds lead dust above the legal limits, this would be appropriate to describe as an imminent lead hazard since dust is acknowledged to be the major source of childhood lead exposure. If an EBL investigation finds deteriorated paint, this would often be appropriate to describe as a lead hazard. Deteriorated paint, if uncorrected, will typically create lead dust or lead soil hazards.

It is harmful to children when owners delay completing LHR work because it extends the child's exposure time to sources of lead. Research shows that longer exposures are more damaging to the brain.

LHD staff can assist property owners to obtain financial resources by referring them to the Wisconsin Department of Administration Division of Housing website. LHD staff can also help owners find lead-certified contractors by referring them to the DHS "Lead-Safe Wisconsin" website. By providing these connections, public health staff can help owners take steps to fix lead hazards and thus expedite completion of LHR orders.

Monitor Certification and Work in Progress – Lead abatement work must be done by a certified lead abatement contractor. However, if the LHD allows the property owner to do non-abatement work to reduce lead hazards, such as re-painting, then either the owner must be certified as a lead-safe renovator or the owner must hire a certified lead-safe renovator. DHS maintains lists of currently certified lead-safe renovators and lead abatement contractors. This information is maintained by the Wisconsin Asbestos and Lead Section, 608-261-6876, and is posted on the Lead-Safe Wisconsin web page.

If staff resources are sufficient and available, then LHD RA/LHI should find out the work schedule and arrange to visit the work site to assure that the workers hold the appropriate level of certification for the required work. The work orders can be written to require that the owner provide notice to the LHD when the work will be done. Similarly, if possible, the LHD staff should monitor the work in progress to assure that contractors use proper dust control methods and that no new lead hazards are created.

Disposal of Lead-Contaminated Materials – In Wisconsin, "lead paint waste from residential projects is considered household waste for disposal purposes and is not subject to hazardous waste regulation. 'Household waste' includes waste from single and multifamily residences, hotels, motels, bunkhouses, ranger stations, crew quarters, picnic grounds and day-use recreational areas. Lead paint waste from households should be collected in plastic bags, sealed and placed in the household trash, or taken to a household hazardous waste collection facility or event."

For more information, consult the Wisconsin Department of Natural Resources (DNR) Bureau of Solid and Hazardous Waste Management. The DNR regulates lead removal and disposal. The publication entitled Commercial and Residential Paint Removal and Disposal includes information about paint removal and disposal and has phone numbers of the regional DNR offices. To ask questions or obtain further information, contact a DNR regional office or the DNR Waste and Materials Management Program at 608-266-2111 or DNRWasteMaterials@Wisconsin.gov.

Clear the Property – When the due date for completion of LHR orders arrives, the certified RA/LHI must conduct a follow-up visit to the site to assure that the work was done safely, that no new lead hazards were created, and that the property meets both visual and dust test clearance standards. Details of the clearance protocol can be found in Wis. Admin. Code DHS 163.14(5).

The first step in clearing the property is to do a visual inspection. The RA/LHI must visually check the job to determine and document that lead hazards were addressed as ordered, that no visible dust, dirt or debris is present and that no new lead hazards were created by the work.

The next step is to collect dust wipe samples from areas where LHR work was ordered. There are rules about timing for clearance wipe samples. A minimum of one hour must pass after the certified contractor does final cleaning activities before the RA/LHI may take dust wipe samples for clearance. See Table 7.7 for guidance about sampling for clearance.

Table 7.7 Sample collection guide for clearance investigations

Interior work with Dust Containment separating work areas from non-work areas	Interior work with No Dust Containment to separate work and non-work areas	Exterior paint disturbing work
Visually inspect entire dwelling to assure that the contractor has addressed all lead hazards, completed the required work, and left no visible paint chips, dust, construction waste or debris. Do not collect wipe samples until dwelling and job site have been visually cleared. If snowfall prevents you from inspecting exterior ground, repeat exterior clearance when snow melts.		
Collect a floor and a window (sill or trough) wipe sample from at least four rooms*. If dwelling has less than four rooms, collect two samples (floor and window sill or trough) per room.	Collect a floor and a window (sill or trough) wipe sample from at least four rooms. If dwelling has less than four rooms, collect two samples (floor and window sill or trough) per room.	Conduct a visual inspection. Look for visible dust or debris on horizontal surfaces in outdoor common area close to work area such as porch, patio, deck, sidewalk or stoop.
Collect at least one floor sample per 2000 sq. ft. of floor from a common area inside the containment.	Collect at least one floor sample in common area per 2000 sq. ft. of floor.	Look for paint chips on the dripline, next to the foundation or any other surface below any exterior work areas.
Collect at least one floor sample outside the containment but within 10 feet of the containment boundary. HUD recommends collecting a floor wipe sample from each walkway used to enter or exit the work area.		Chip, soil or wipe samples are discretionary. If exterior work may have contaminated exterior porch floors or stairs, collecting dust samples is advisable.

* The term room includes hallways, stairwells and any other living areas.

DHS 163.14(5) requires a minimum of four floor dust wipe samples and four window dust wipe samples from four different rooms for clearance. These samples must meet clearance dust standards for the component before the property can be considered cleared and safe for re-occupancy. Current Wisconsin standards for single surface dust sampling are provided in Table 7.8. If the results exceed these standards, LHDs must order additional work and re-investigate when the work is done until clearance standards are met.

Table 7.8 Wisconsin Standards for Single Surface Dust Sampling

Surface	Leaded Dust Loading (mcg/dL)
Floors	40
Interior window sills/stools	250
Window wells/troughs	400

Source: Wis. Admin. Code DHS 163.14(5) clearance.

If the work orders address exterior soil hazards only, dust samples may not be required. If, for example, the only corrective action is to cover bare soil with mulch or new grass, then a visual assessment is sufficient for clearance. In any case, the RA/LHI conducting the clearance must provide a written clearance report to the property owner and tenant within 10 working days of the field investigation or within 10 days of when the laboratory reports results of their analysis of the environmental samples sent to the laboratory for analysis. Contents of the written clearance reports activities are detailed in Wis. Admin. Code DHS 163.14(5).

When the property is cleared, the RA/LHI must complete and submit the Property Investigation Closure Report (F-44771D; also see Appendix A) to inform WCLPPP of the status of the property.

Enforcement of Lead Hazard Reduction

The property owner is responsible for reducing identified lead hazards as ordered by the LHD. The property owner's responsibility to correct identified lead hazards remains even if the lead poisoned child living there at the time of diagnosis moves out and is no longer in occupancy.

For communities without a local ordinance, Wis. Stat. 254 provides several tools to enforce the statute when property owners are not compliant (see Table 7.2). For example, LHDs can post notices on the property in a conspicuous place indicating that a lead hazard is present under the authority of Wis. Stat. 254.166(2)(a). Many LHDs have used this strategy with productive results. Examples of such placards are shown in the Appendices.

Local health departments, under Wis. Stat. 254.59, may choose to pay for the correction of human health hazards (including lead) and then seek repayment for these costs from the property owner through local municipal property taxes.

In addition, under Wis. Stat. 254.59, an owner who maintains a human health hazard may be fined up to $300 or imprisoned for up to 90 days or both.

Racine has used some of the additional enforcement authority described in Wis. Stat. 254.595 to file "lis pendens" to motivate owners to comply with their local housing code. Essentially this ensures potential buyers find out that repairs are required when they do a title search.

Finally, if the property owner does not comply with orders to correct lead hazards, the LHD may report the violation of the law to the district attorney of the county in which the property is located for enforcement of the statute. Violators of the law are subject to civil and criminal penalties and fines. Many communities have sought enforcement to motivate noncompliant owners in this way (through Wis. Stat. 254.30). Typically this is time consuming since it requires the involvement of three levels of government: the LHD, county district attorney, and the state

law. LHDs report varied results when using Wis. Stat. 254.30 to motivate owners to fix lead hazards.

Local Ordinances – Since it is often so time consuming to assure that property owners correct lead hazards in housing and comply with orders in a timely manner, many communities have established local housing ordinances. Local ordinances can help LHDs to expedite the resolution of cases involving property owners who do not correct lead hazards within appropriate time limits. Historically, property owners in communities with local ordinances such as Milwaukee and Racine comply more quickly with LHR orders than owners in other Wisconsin communities. Many Wisconsin communities report that lead cases can move quickly through their municipal legal systems both because the parties may be more familiar with each other and because the parties are more familiar with childhood lead poisoning as an important issue. Others have suggested that "The act of appearing before a judge in a court of law seems to have served as an incentive for many owners." (Campbell et al., 2013)

Communities where public awareness about lead poisoning is great enough to support passage of an ordinance also tend to be better educated about lead and the threat it poses to children's health. These communities respond more promptly to lead poisoning, partly because owners are educated about the need to correct hazards and partly because judges are educated about the issues and act quickly to enforce the local ordinances.

Detailed and Current Information on Lead Hazard Reduction

For a full discussion of how to conduct interim controls and lead abatement, the following are excellent resources:

- *HUD Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, 2012 Edition*, especially Chapters 11-16.

For information presented in a simply written and well-illustrated format that emphasizes interim controls, and low cost, practical abatement measures, see:

- *Lead Paint Safety: A Field Guide for Painting, Home Maintenance, and Renovation Work*, U.S. Department of Housing and Urban Development, Office of Lead Hazard Control, June 1999. Copies are also available from the National Lead Information Center at 1-800-424-5323. Note that this booklet was published before EPA issued the Lead Safe Renovator Rule, so the text is out of date from a regulatory perspective. The building science underlying the text and illustrations remains valid.

For the most current information on federal law and regulations regarding LHR, check the following internet sites:

- HUD at www.hud.gov/offices/lead
- EPA's National Lead Information Center at www.epa.gov/lead
- National Center for Healthy Housing at www.nchh.org

For current information on Wisconsin statutes relating to childhood lead poisoning and LHR activity, see Chapter 2 or https://www.dhs.wisconsin.gov/lead/regs-state.htm.

Certification and Training of Lead Hazard Reduction Workers

Wisconsin Law requires that anyone who conducts an EBL investigation must be a certified RA/LHI [Wis. Admin. Code DHS 163.14(2)]. The Division of Public Health (DPH) in DHS is committed to facilitating training for LHD staff by providing low-cost refresher training and re-certification.

After identifying and evaluating lead hazards in dwellings occupied by children with lead poisoning, and depending on what kind of work is ordered, LHDs have some discretion about what level of trained and certified contractors they require owners to use. LHDs can order owners to use either (a) certified lead abatement contractors to permanently correct lead hazards or (b) certified lead safe renovators to temporarily and safely correct lead hazards by cleaning, safely preparing surfaces for painting and re-painting.

Lead abatement always requires certified lead abatement contractors. Lead abatement certified contractors are also required when the work is:

- ✓ Ordered by the LHD to be completed by certified lead abatement contractors
- ✓ Funded by a grant that requires the work to be completed by certified lead abatement contractors

The Wisconsin Asbestos and Lead Database Online (WALDO) is the source for information about training, certification, and work practice requirements for LHR. See https://www.dhs.wisconsin.gov/waldo/index.htm to find answers to questions about:

- ✓ How to obtain certification for various lead disciplines;
- ✓ What certification is required for persons doing LHR or lead investigation work;
- ✓ When certification is due for a refresher course in each discipline;
- ✓ Who is certified in Wisconsin;
- ✓ Which accredited training providers provide training opportunities.

The website also contains numerous links to other state and local programs with information about LHR. The program can be reached by calling 608-261-6876 or email to: dhsasbestoslead@wisconsin.gov.

Funding for Lead Hazard Reduction

Funding for LHR activities remains the primary responsibility of the property owner. This is a major challenge in bringing about the elimination of the sources of childhood lead poisoning. Federal grants that are often awarded to local government or non-profit agencies may be found by checking the internet sources for HUD and EPA. When funding opportunities are known to WCLPPP, the program attempts to notify LHDs by email with information on how to access the application materials.

In addition, LHDs are encouraged to communicate and collaborate with local funding sources (such as banks, savings and loans, credit unions) and housing agencies (such as weatherization agencies or Community Development Block Grant agencies) to assist with building the capacity for lead-safe renovation work, financing, and the improvement of quality, affordable, lead-safe housing throughout their community.

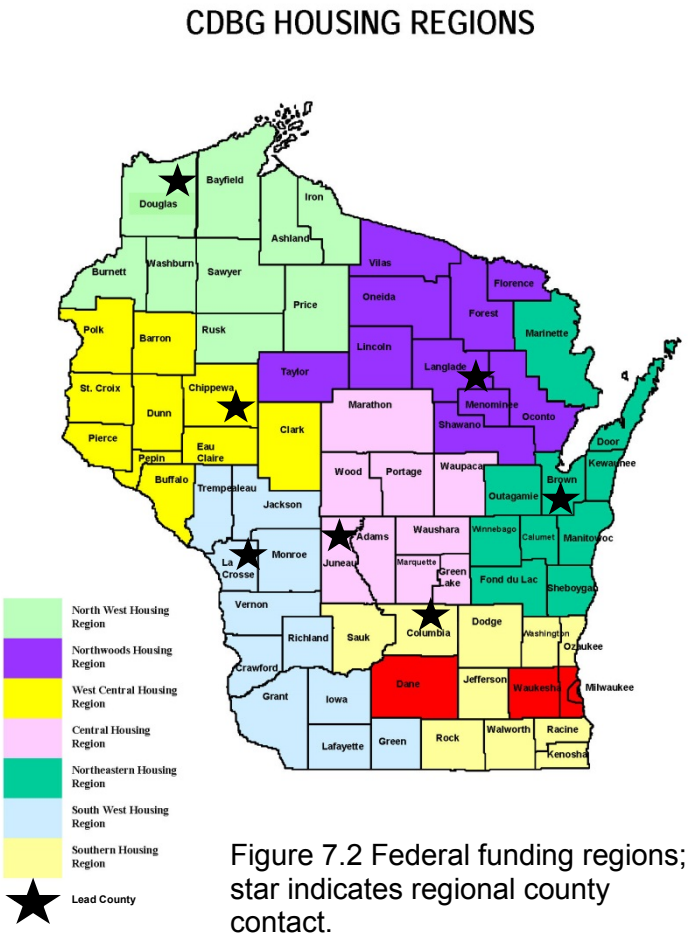


Figure 7.2 Federal funding regions; star indicates regional county contact.

The Wisconsin Department of Administration, Division of Housing, Bureau of Affordable Housing maintains lists of agencies that offer loans and grants for housing rehabilitation and LHR and posts links to these resources on their website. The Division of Housing distributes the CDBG Housing and HOME program funds that HUD allocates to Wisconsin among all Wisconsin communities except those which get their own funding directly from HUD. For purposes of distributing CDBG funds, the Division of Housing divides the state into seven regions with a principal county contact in each region (see Figure 7.2).

The Division of Housing has two other funding and resource booklets. Household Housing Guide includes a list of funding sources for low- and moderate-income owner-occupied dwellings. The Rental Housing Guide includes a list of funding sources for low- and moderate-income rental properties.

References

Campbell, C., Gracely, E., Pan, S., Cummings, C., Palermo, P., Gould, G., (2013). Public Health and Law Collaboration: The Philadelphia Lead Court Study. *American Journal of Public Health*, 103(7), 1271-1277.

Centers for Disease Control and Prevention, *Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention,* Report of the Advisory Committee on Childhood Lead Poisoning Prevention, *January 4, 2012.*

Clark, S., Galke, W., Succop, P., Grote, J., McLaine, P., Wilson, J., Dixon, S., Menrath, W., Roda, S., Chen, M., Bornschien, R., Jacobs, D., (2011). Effects of HUD-Supported Lead Hazard Control Interventions in Housing on Children's Blood Lead. *Environmental Research*, 111(2), 301-11.

Dixon, S.L., Wilson, J.W., Clark, S.C., Galke, W.A., Succop, P.A., Chen, M. (2005). Effectiveness of Lead-hazard Control Interventions on Dust Lead Loadings: Findings from the Evaluation of the HUD Lead-Based Paint Hazard Control Grant Program. *Environmental Research*, 98(3), 303-14. (http://www.ncbi.nlm.nih.gov/pubmed/15910785)

Dixon, S.L., Jacobs, D.E., Wilson, J.W., Akoto, J.Y., Nevin, R., Clark, S.C., (2010). Window Replacement and Residential Lead Paint Hazard Control 12 Years Later; *Environmental Research*, 113, 14-20. (http://www.ncbi.nlm.nih.gov/pubmed/22325333)

U.S. Department of Housing and Urban Development (2001). Lead Paint Safety: A Field Guide for Painting, Home Maintenance, and Renovation Work, (http://www.hud.gov/offices/lead/training/LBPguide.pdf)

Levin,. R., Brown, M.J., Kashtock, M.E., Jacobs, D.E., Whelan, E.A., Rodman, J., Schock, M.R., Padilla, A., Sinks, T., (2008). "Lead Exposures in U.S. Children, 2008: Implications for Prevention." *Environmental Health Perspectives* 116(10), 1285-1293.

The National Center for Lead Safe Housing, (1995). Does Residential Lead-Based Paint Hazard Control Work? A Review of the Scientific Evidence. Columbia, MD. (http://www.nchh.org/Portals/0/Contents/Residential_Lead_Based_Paint%20Hazard_Control_Work.pdf)

The Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X of the Housing and Community Development Act of 1992). Public Law 102-550, Section 1017.

U.S. Environmental Protection Agency, *Model Accreditation Program for the Lead Inspector and Risk Assessor.*

U.S. Environmental Protection Agency National Lead Laboratory Accreditation Program (http://www2.epa.gov/lead/national-lead-laboratory-accreditation-program-nllap)

U.S. Environmental Protection Agency. 1998 *Review of Studies Addressing Lead Abatement Effectiveness*, (http://www2.epa.gov/sites/production/files/documents/finalreport.pdf)

U.S. Department of Housing and Urban Development. (2012) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*, Washington, D.C.

Wilson, J., Pivetz, T., Ashley, P., Jacobs, D., Strauss, W., Menkedick, J., Dixon, S., Tsai, H., C., Brown, V., Friedman, W., Galke, W., Clark, S. (2006). Evaluation of HUD-funded Lead Hazard Control Treatments at 6 Years Post-intervention; *Environmental Research*, 102(2): 237-48. (http://www.ncbi.nlm.nih.gov/pubmed/16740256)

Zierold, K.M., Havlena, J., Anderson, H. (2007). Exposure to Lead and Length of Time Needed to Make Homes Lead-Safe for Young Children. *American Journal of Public Health*, 97, 267-270 (http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1781393/pdf/0970267.pdf)

Chapter 8

Medical Management of Childhood Lead Poisoning

Contents

In Brief: Recommended Actions Based on Blood Lead Level (CDC, 2012) 8.2

Introduction 8.3

Diagnostic and Follow-up Testing 8.3

Clinical Assessment of Children with Lead Poisoning 8.4

- What the Erythrocyte Protoporphyrin (EP) Test Measures 8.6
- Iron Deficiency, Pica and Lead Poisoning 8.7
- Chelation Therapy 8.9

Lead Education for the Family 8.11

Coordinating Care 8.11

Monitoring a Child's Neurodevelopmental Progress 8.12

References 8.13

Wisconsin Department of Health Services

(P-00660, 11/2014)

In Brief: Recommended Actions Based on Blood Lead Level (CDC, 2012)

<5 mcg/dL	5-44 mcg/dL	45-69 mcg/dL	≥70 mcg/dL
• Lead education - Dietary - Environmental • Environmental assessment* for pre-1978 housing • Follow-up blood lead monitoring	• Lead education - Dietary - Environmental • Follow-up blood lead monitoring • Complete history and physical exam • Lab work: - Iron status - Consider hemoglobin or hematocrit - Erythrocyte Protoporphyrin (EP) at BLL ≥20 mcg/dL** • Environmental investigation • Lead hazard reduction • Neurodevelopmental monitoring • Abdominal X-ray (if particulate lead ingestion is suspected) with bowel decontamination if indicated	• Lead education - Dietary - Environmental • Follow-up blood lead monitoring • Complete history and physical exam • Lab work: - Hemoglobin or hematocrit - Iron status - EP • Environmental investigation • Lead hazard reduction • Neurodevelopmental monitoring • Abdominal X-ray with bowel decontamination if indicated • Oral chelation therapy. Consider hospitalization if lead-safe environment cannot be assured	• Hospitalize and commence chelation therapy (following confirmatory venous blood lead test) in conjunction with consultation from a medical toxicologist or a pediatric environmental health specialty unit • Proceed according to actions for 45-69 mcg/dL

* The scope of an "environmental assessment" will vary based on local resources and site conditions. However, this would include at a minimum a visual assessment of paint and housing conditions, but may also include testing of paint, soil, dust, and water and other lead sources. This may also include looking for exposure from imported cosmetics, folk remedies, pottery, food, toys, etc., which may be more important with low-level exposure.

** An EP test should routinely be obtained on any child with a diagnostic BLL ≥20 mcg/dL, and paired with any follow-up BLLs that are drawn (see Figure 8.1).

Source: Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, Centers for Disease Control and Prevention (CDC), January 4, 2012

Introduction

Clinicians have an important role in preventing lead exposure and in managing lead-exposed children. This role is described in Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention (CDC, 2012, January 4), and includes:

1. Screening questions, outreach and education to minimize exposures prior to blood lead testing;
2. Emphasizing healthy nutrition and/or dietary supplements to reduce absorption;
3. Blood lead testing to promptly identify exposed children, for whom primary prevention has failed;
4. Intervening appropriately when clinically indicated;
5. Overseeing ongoing monitoring of children with elevated blood lead levels (EBLLs), defined as levels at or above the reference value (i.e., 5 mcg/dL);
6. Coordinating efforts with parents and local and state authorities to minimize risks to individual children and to assist communities in their primary prevention efforts.

Medical management of lead poisoning in children has been largely predicated on a secondary prevention model, i.e., intervention after an elevated blood lead level has been detected, usually prior to the onset of symptoms. Screening programs are the main vehicle for identifying children with lead poisoning. Once a child is identified to be at risk for lead poisoning, early detection is provided by physicians through blood lead screening tests (see Chapter 5: Screening and Diagnosis of Lead Poisoning).

Diagnostic and Follow-up Testing

A diagnosis of lead poisoning is made based on a venous blood test. When a child has a capillary blood lead test ≥5 mcg/dL, a diagnostic venous blood test should be obtained to assure accuracy. See Table 8.1 for the recommended schedule for obtaining a confirmatory venous sample (CDC, 2012). In general, the higher the blood lead level (BLL), the sooner the confirmatory test should be done. The CDC recommends that BLLs of 10 – 44 mcg/dL are confirmed within 1 week – 1 month, noting that the higher the BLL on the screening test, the more urgent the need for confirmatory testing. Children whose BLL is at the upper end of this range should receive a confirmatory test in approximately one week if possible.

Table 8.1. Recommended schedule for obtaining a confirmatory venous sample (CDC, 2012)

Blood lead level (mcg/dL)	Time to confirmation testing
≥ 5–9	1 – 3 months
10–44	1 week – 1 month*
45–59	48 hours
60–69	24 hours
≥ 70	Urgently as emergency test

* The higher the BLL on the screening test, the more urgent the need for confirmatory testing.

Source: Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, Centers for Disease Control and Prevention, January 4, 2012.

In the event that it's not possible to obtain a confirmatory venous sample from the child, a second capillary sample drawn within 12 weeks of the initial screening test can be considered a confirmatory test. This is consistent with the standard surveillance definitions used by the CDC to classify confirmed and unconfirmed elevated BLLs. If the second capillary test result is elevated, all follow-up tests should be performed on venous samples.

When lead poisoning is diagnosed, follow-up tests should be performed on venous blood samples to monitor the child's BLL and to evaluate the effectiveness of interventions. The scheduling of follow-up tests depends on the diagnostic BLL (see Table 8.2). Even in the best laboratories, variations in test results of ±2 mcg/dL are normal and are well within the acceptable lab error. Multiple blood lead tests are needed over time to examine the true trend in a child's actual BLLs. Blood lead levels that rise may be indicative of an unrecognized source of exposure, inappropriate abatement activities, failure to mitigate the identified hazard, or the redistribution of lead stores within the child's body.

Table 8.2. Schedule for follow-up blood lead testing[a] (CDC, 2012)

Venous blood lead level (mcg/dL)	Early follow-up testing (2 – 4 tests after identification)	Later follow-up testing after blood lead level declining
≥ 5–9	3 months *	6 – 9 months
10–19	1 – 3 months *	3 – 6 months
20–24	1 – 3 months *	1 – 3 months
25–44	2 weeks – 1 month	1 month
≥ 45	As soon as possible	As soon as possible

[a] Seasonal variation of BLLs exists and may be more apparent in colder climate areas. Greater exposure in the summer months may necessitate more frequent follow-ups.
[*] Some case managers or clinicians may choose to repeat blood lead tests on all new patients within a month to ensure that their BLL is not rising more quickly than anticipated.

Source: Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, Centers for Disease Control and Prevention, January 4, 2012.

Clinical Assessment of Children with Lead Poisoning

Table 8.3 provides a summary of the components of clinical assessment. These components are based on the experience of clinicians who have treated lead-poisoned children, and should not be seen as rigid rules but as a guide for clinical decisions.

Today, most children with lead poisoning have no symptoms. The detrimental effects of BLLs below 45 mcg/dL are often subclinical and may include neurodevelopmental impairment often apparent only at a later age. It is critical that the primary care provider (PCP) and case manager not equate the absence of clinical symptoms, physical abnormalities, or abnormal laboratory results with an absence of toxicity.

Table 8.3. Components of clinical assessment

Component	Content	Action Steps
Medical History	Ask about: • Symptoms (most children with lead poisoning are asymptomatic). • Developmental history. • Mouthing activities. • Pica behaviors. • Previous BLL measurements. • Family history of lead poisoning.	If there are delays or lags in developmental progress, the child should be referred to an early intervention program for further assessment.
Environmental History	Ask about: • The age, condition and how long they have lived at the primary residence. • Remodeling, renovation, or repainting within the last year in the home. • Ask the same questions about other places the child spends time (including secondary homes and daycare) or previous residences. • Occupational and hobby histories of adults with whom the child spends time. • Use of imported dishes, cosmetics, toys, medicines. • Local environmental risk factors that may be provided by the local health department.	Refer to the local health department for further assessment, environmental investigation, and lead hazard reduction.
Nutritional History	Ask about: • Usual foods eaten and eating patterns. • WIC or other food program participation. • The child's iron status, using appropriate laboratory tests.	Provide treatment for iron deficiency if diagnosed. Refer for nutritional counseling. Refer to WIC if income eligible.
Physical Examination	Pay particular attention to the neurodevelopmental examination and the child's psychosocial and language development.	Findings of any delay in language, neurobehavioral or cognitive problems should result in referral to appropriate programs. During early school years, further examinations are necessary to facilitate entry into appropriate educational programs.

Source: Adapted from Screening Young Children for Lead Poisoning, Centers for Disease Control and Prevention, 1997.

What the Erythrocyte Protoporphyrin (EP) Test Measures

Protoporphyrin is the last precursor in synthesis of heme, the oxygen-carrying component of red blood cells (erythrocytes). Small amounts of protoporphyrin are normally present in erythrocytes, hence the term erythrocyte protoporphyrin. Pathological conditions that impair heme synthesis also cause elevations in EP concentrations. The majority (90%) of EP in the blood is bound to zinc, and is referred to as zinc protoporphyrin (ZP). Because the life span of erythrocytes in the blood stream is 90-120 days, the result of an individual EP test reflects the average effect on heme synthesis over 90-120 days. This makes the EP tests an ideal partner with BLLs, which can fluctuate over a shorter period of time, to tell the story of lead poisoning.

The terminology associated with EP test results can be confusing. You may see an EP result referred to as erythrocyte protoporphyrin (EP), zinc protoporphyrin (ZP), or free erythrocyte protoporphyrin (FEP). Technically these terms refer to different substances. However, in practice they are often used interchangeably, and test results can generally be interpreted in identical fashion. The confusion is the result of early methods of laboratory analysis and historical gaps in knowledge about the nature of blood protoporphyrin.

Reporting Units – EP test results are most commonly reported as:

- μmol EP/mol Heme: molar ratio of protoporphyrin to heme
- μg EP or ZP/dL Whole Blood: micrograms per deciliter of whole blood concentration units of EP or ZP

When reported in μg/dL (or mcg/dL) reporting units, EP and ZP results are approximately equivalent. A value exceeding 35 μg/dL is widely accepted as indicative of pathology. Results exceeding 70 μmol/mol are accepted as indicative of pathology. An EP level higher than the threshold value does not indicate the reason for the elevation; further tests for iron deficiency and/or lead poisoning must be performed.

Usefulness of Erythrocyte Protoporphyrin Testing – Lead in the blood begins to cause an increase in EP at levels of 15-20 mcg/dL. As the lead level rises, the EP level rises exponentially. Paired results of EP and BLL can provide information on the effect, extent, and duration of lead exposure. An elevated BLL along with a normal or near-normal EP may indicate that the lead exposure has been recent and/or short term. An elevated EP level with a minimal increase in BLL may indicate a higher past lead exposure and a continuing body burden of lead. Elevation of both EP and BLL may indicate prolonged and ongoing lead exposure.

Figure 8.1 is an article written by Dr. Margaret Layde, former Assistant Professor Medical College of Wisconsin, Downtown Health Center, Milwaukee, which describes the usefulness of the EP test in monitoring children with a BLL $\geq$20 mcg/dL and post-chelation. In general, an EP test should routinely be obtained on any child with a diagnostic BLL $\geq$20 mcg/dL, and paired with any follow-up BLLs that are drawn.

Figure 8.1. Usefulness of Erythrocyte Protoporphyrin

Usefulness of Erythrocyte Protoporphyrin Tests in Children with Elevated Blood Lead Levels

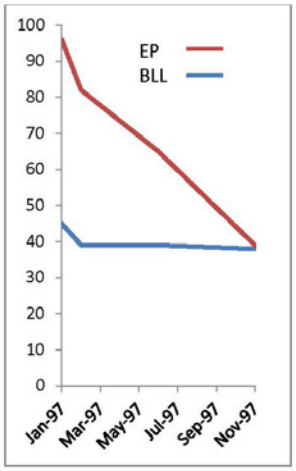
Written for the Lead Report by
Margaret Layde, M.D.
Assistant Professor
Medical College of Wisconsin
Downtown Health Center

A blood lead level (BLL) is the screening test of choice to detect increased lead burden in children. However, BLLs are a poor indicator of the total body burden of lead. With chronic or prolonged lead exposure, the BLL represents only 1-2% of the lead on the body, only the tip of the iceberg. The majority of the lead is in the tissue and the bone.

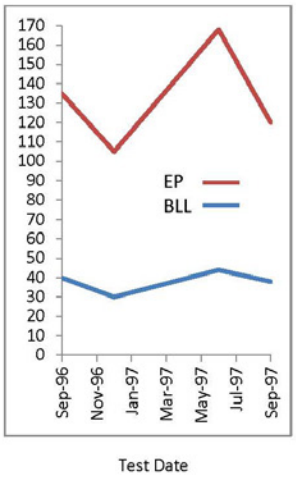
This is where Erythrocyte Protoporphyrin (EP) levels can provide additional information on body tissue levels. Protoporphyrin is the last precursor in hemoglobin synthesis in the body. Elevated levels of EP reflect impaired heme synthesis, one of the enzymes inhibited by lead. Iron deficiency and hemolytic anemia will also cause an elevated EP, so these must be rules out.

Although EP is not as sensitive as a screening tool for lead exposure, it helps measure the effects of lead on the body tissues. At the present time we do not have a better way to measure the total body burden of lead. For example, a child with a BLL of 33 and EP of 200 has a much higher total body burden of lead than a child with a BLL of 33 and an EP of 80 or 40. The higher the EP, the more persistent the BLL elevations will be, provided we have ruled out iron deficiency.

The half life of lead in the body is very long (about 30 years). Most of it is bound to the bone, but it is in a steady state of equilibrium with the blood lead. It can be very frustrating to monitor the slow decreases in BLL in a child previously exposed to lead. The EP levels more accurately reflect the progress in decreasing the lead burden in the body tissue. In this example, one three-year-old boy was monitored every 2 to 4 weeks for 6 months. His BLLL remained high, but his EP showed the effects of chelation and removing lead hazards (see below).



Post chelation is another time when following both the EP and BLL can be useful. We expect the BLL to decrease dramatically and then rebound in a month or two following chelation, as the bone lead re-equilibriates with the blood lead. The blood lead often will return to around 70% of the pre-chelation level. It can be difficult to know if the child continues to be exposed to lead without also monitoring the EP. The EP should continue to decrease unless there is a new exposure. For example, this girl was re-exposed to lead hazards between December 1996 and January 1997 (see below).



In summary, EP levels are a useful adjunct in monitoring children with a BLL of 20 micrograms per deciliter or greater. EP indicates the extent of the total body burden of lead and is useful post chelation to follow progress in decreasing the total body lead burden and ensuring no new lead exposure.

Iron Deficiency, Pica and Lead Poisoning

Iron Deficiency – Iron deficiency can enhance lead absorption and often co-exists with lead poisoning. In addition, research indicates that iron deficiency in young children can be an independent neurotoxin, as well as enhancing the effects of lead poisoning on the central nervous system.

Adequate iron intake lowers lead absorption, and should be considered an essential secondary tool to protect children from absorbing lead they ingest from their environments. While lead exposure does not begin to disrupt red blood cell production until BLLs reach approximately 40 mcg/dL, low iron stores promote absorption of lead at any BLL. Many U.S. children 1 to 2 years of age have daily iron intake below recommended amounts. When exposed to lead hazards, these children may see the lasting effects on cognitive development due to both iron deficiency and the long-lasting negative effects due to lead.

All children with BLLs ≥5 mcg/dL should be evaluated for iron deficiency. Several tests are used to determine the iron status of a child, but they vary as to their sensitivity and specificity in identifying the cause of iron deficiency. An EP test is a good screening tool but must be followed by other diagnostic tests to determine the exact cause of iron deficiency. An increase in EP is the first biochemical change in erythrocytes due to insufficient iron levels. The advantage of the EP test to measure iron sufficiency is that it reflects iron status in bone marrow, and is more stable than other tests. The disadvantages are that EP is slow to change as a result of dietary iron supplements, and it is non-specific as to the cause of the deficit. Otitis media and respiratory infections in children can cause EP elevations, and are a complicating factor in interpreting test results. The EP can also be elevated due to liver disease and malignancy. Hematocrit and hemoglobin are crude measures of iron status, reflecting only cases of frank anemia.

Serum iron and iron binding capacity (transferrin saturation) and ferritin are the most sensitive indicators of iron status. An abnormally low ratio of serum iron to iron binding capacity (transferrin saturation) of 0.2 is consistent with iron deficiency. The serum ferritin level, however, is the most definitive and accurate indication of overall iron status, although it is an acute phase reactant and may be falsely elevated in sick children; a value ≤12 mcg/dL indicates iron deficiency

If iron deficiency is diagnosed, treatment should begin along with treatment of the lead exposure. [*Note: Children receiving BAL (dimercaprol) as a chelating agent should not be treated for iron deficiency until the drug therapy is completed.]*

See Chapter 9 for more information on nutrition and childhood lead poisoning.

Pica – Although formal pica definitions vary, the behavior common to all definitions of pica is a pattern of deliberate ingestion of nonfood items. For example, MedlinePlus Medical Encyclopedia defines pica as “a pattern of eating non-food materials, such as dirt or paper.” According to the DSM-5, to be diagnosed with pica a person must display:

- Persistent eating of non-nutritive substances for a period of at least one month.
- The eating of non-nutritive substances is inappropriate to the developmental level of the individual.
- The eating behaviour is not part of a culturally supported or socially normative practice.
- If occurring in the presence of another mental disorder (e.g. autistic spectrum disorder), or during a medical condition (e.g. pregnancy), it is severe enough to warrant independent clinical attention.

Note: Pica often occurs with other mental health disorders associated with impaired functioning.

Materials ingested pica can be benign or potentially harmful. There is a wide range of items associated with pica, such as chalk, newsprint, ice, pencil erasers, paint chips, dirt, clay, and pottery. Pica has long been recognized as a risk factor for lead poisoning. Lead poisoning can be associated with pica if the child is consuming substances that are contaminated with lead, such as lead-contaminated soil or paint chips. Pica is sometimes associated with anemia and other nutritional deficiencies, e.g., iron or zinc.

Pica is most often observed in pregnant women, immigrant communities, and young children. Parents may underreport their child's pica behavior because of embarrassment, or they may not be aware that the behavior is worth reporting (Rose, E. A., Porcerelli, J. H., & Neale, A. V., 2000). Pica is often discovered when a complication, such as lead poisoning, is diagnosed and careful questioning follows about eating habits. An open discussion with the family about favorite foods and nonfood substances might aid in the diagnosis. If pica is suspected, but parents are unaware of the behavior, physicians should ask that parents and caregivers keep records of observations of the child's solitary play.

Abdominal radiographs may be useful in determining whether children are currently ingesting lead-contaminated non-food items, including paint chips. They are particularly useful when children have an unexpected acute rise in BLL or are not responding to case management as expected.

Treatment for pica may vary by patient and suspected cause (e.g., child, developmentally disabled or pregnant) and may emphasize psychosocial, environmental and family-guidance approaches. Diagnosis and treatment of pica should begin by assessing and addressing any missing nutrients or other medical problems, such as lead poisoning. Behavior-based treatment options can be useful, such as teaching the child through positive reinforcement which foods are good and which ones they should not eat.

Chelation Therapy

The single most important factor in management of childhood lead poisoning is reducing the child's exposure to lead; some children, however, will benefit from chelation therapy. The CDC recommends chelation therapy for children with a venous BLL $\geq$45 mcg/dL to reduce the BLL more quickly. Chelation therapy is not a substitute for effective and rapid environmental interventions and should only be used as part of an integrated environmental and medical approach to treating children with lead poisoning. Children receiving chelation therapy for treatment of lead poisoning require special care and consideration by the health care team. Primary care providers should consult with an expert in the management of lead chemotherapy prior to initiating chelation therapy. The PCP can contact the Poison Center at 1-800-222-1222 for information on treatment. Public health nurses should be in communication with the child's physician regularly, to discuss the plan of care, follow-up, and to assure that the child is in a lead-safe environment when receiving chelation.

There are several drugs, or chelating agents, that can be used in the treatment of lead poisoning. These drugs are capable of binding or chelating lead and deplete the soft and hard (skeletal) tissues of lead and thus reduce its acute toxicity. All drugs have potential side effects and must be used with caution. The American Academy of Pediatrics Committee on Drugs published *"Treatment Guidelines for Lead Exposure in Children,"* which contains a good summary of chelation with the most commonly used agents.

A commonly used oral chelating agent is succimer (generic name). The product name for this drug is Chemet. The abbreviation for its chemical name is DMSA. Research found that chelation therapy with Succimer lowered average BLLs for about six months but resulted in no benefits in cognitive, behavioral and neuromotor endpoints.

When to Start Chelation Therapy – As noted above, a child with a venous BLL ≥45 mcg/dL should be removed from the source(s) of lead exposure and treated promptly with appropriate chelating agents. If the BLL is between 45-69 mcg/dL, a second venous BLL should be drawn before initiating chelation to assure that therapy is based on the most recent and reliable information possible. If the BLL is ≥70 mcg/dL, the child should be hospitalized and chelation therapy should be initiated immediately while the second venous BLL is pending.

The Child's Environment during Chelation – Clinicians and public health professionals should assure that the child is living in a lead-safe environment before chelation is started. The initiation of outpatient chelation may need to be delayed until a lead-safe environment can be found. If the child receives chelation as a hospital patient, discharge may need to be delayed until the child's home is determined to be lead-safe or an alternate lead-safe location can be found for the child to stay temporarily upon discharge.

Chelation Information for the Family – Families whose children are receiving chelation therapy need adequate information for chelation to have a successful outcome. This education should address the following topics:

- The need and importance of a lead-safe environment during and after chelation. It is often difficult for families to secure a lead-safe place at the same time the child is hospitalized or started on a new medicine. However, it is one of the most important tasks for them to undertake during this time.
- The name of the drug, dose, route of administration, schedule, and side effects of the chelating agent being used. This is especially important if the parent is responsible for administering an oral chelating drug to the child.
- The importance of follow-up blood lead and EP testing (see below).

Blood Lead and Erythrocyte Protoporphyrin Tests after Chelation – Post-chelation venous blood lead and EP levels should be obtained every few weeks for several months. Within a month or two after chelation is completed, the BLL may rebound to around 70 percent of the pre-chelation level as lead is released from the bone and re-enters the bloodstream. If the BLL rebounds to 45 mcg/dL or greater, chelation may need to be repeated. The EP level, in combination with a BLL, can be useful in differentiating between post-chelation blood lead rebound and ongoing exposure to lead. The EP level should continue to decrease after chelation unless there is a new exposure. An increase in both the BLL and EP level after chelation is an indication of re-exposure to lead. Further investigation should be done in this situation to identify the ongoing, or new, source of lead exposure.

Unapproved "Chelation" Drugs – In October 2010, the U.S. Food and Drug Administration (FDA) warned eight companies to stop selling so-called "chelation" products that claim to treat a range of disorders from autism to Alzheimer's disease. The FDA said the companies have not proven their products are safe and effective in treating autism spectrum disorder, cardiovascular disease, macular degeneration, Parkinson's disease or any other serious illness. Some of the companies also claim their products can detect the presence of heavy metals in the body in an attempt to justify the need for chelation therapy. FDA said consumers should avoid non-

prescription products offered for chelation or detoxification. FDA-approved chelating agents are available by prescription only and are approved for use in specific indications such as the treatment of lead poisoning and iron overload. The agency says even the prescription medications carry significant risks, and they should only be used with medical supervision.

Lead Education for the Family

Health care providers should be aware that even at the lowest BLLs, there is action they can take to help the parents prevent a further increase in the child's BLL. They should offer information to the parents about the meaning of the elevated blood lead test results, sources of lead exposure, steps the parents can take to protect their child, and the need for ongoing medical follow-up and blood lead testing. Education is one of the most important components of medical management. (See Chapter 4 for a detailed discussion about education strategies and resources.)

Coordinating Care

Children with lead poisoning require comprehensive services to address a range of needs. This is best accomplished with a team of professionals. The local health department (LHD) provides case management services and environmental investigation of the child's home. When lead hazards are identified in the home, the property owner is responsible for eliminating the lead hazards identified as causing the child's lead poisoning. The physician provides ongoing assessment through age-appropriate physical exams, follow-up venous blood lead tests, chelation therapy if appropriate, and long-term monitoring for the development of cognitive, learning and behavioral deficits. The caregiver must be diligent in implementing steps to prevent ongoing lead exposure and provide support for the child. If a child presents without symptoms, the child's PCP and case manager may have trouble convincing the child's caregiver of the importance of suggested interventions. The PCP and case manager should manage each child individually, taking into consideration the child's BLL and the ability of caregivers to cooperate and implement interventions.

Public health staff typically coordinates the follow-up care provided to the child and family. LHD staff should assure that the PCP is included in discussing, planning and providing services so the public and private health care systems function as a team. Effective interactions between private health care providers and public health will lead to the most effective treatment of a child with lead poisoning. These interactions begin with communication about the results of screening and follow-up tests, and extend to physical examinations, developmental assessments, nutritional assessments, environmental interventions, and education and referrals. Both the child and the family benefit from efforts by public health and health care providers to complement each other's work.

When a diagnosis of lead poisoning is made, identification and control of ongoing sources of lead exposure for the child should be the highest priority. Health care providers should coordinate patient care with the LHD to assure prompt investigation and control of the sources of lead exposure. Although housing-based intervention services are typically outside the clinician's role, medical and environmental interventions should be implemented simultaneously to best protect the child.

Childhood lead exposure typically results from sub-standard housing. Families with limited housing choices are more likely to live in deteriorated housing, and may also face other

problems such as unemployment, poverty, lack of routine medical care, poor nutrition, and instability. Families of children with lead poisoning may also need other support, and a follow-up team can refer them to other services for which they may be eligible.

Monitoring a Child's Neurodevelopmental Progress

Long-term follow-up of lead-poisoned children requires attention to the developmental and neurobehavioral effects of lead poisoning. Neurodevelopmental monitoring should continue long after a child is initially diagnosed with lead poisoning as many deficits will not manifest themselves until after a child starts school. This can be challenging, depending on the consistency of the child's source of medical care. Health care providers should include a child's history of lead poisoning in the problem list maintained in the child's medical record. If a child changes his or her PCP, this will ensure the information is transmitted to the next provider. Public health involvement routinely ends when the child's BLL drops and the source of lead exposure has been eliminated. However, public health professionals can play a key role in assuring that the family and the primary health care provider are aware that the neurodevelopmental status of the lead-poisoned child should be evaluated on an ongoing basis. (See Chapter 10 for a detailed discussion of neurodevelopmental surveillance for lead-poisoned children.)

References

American Academy of Pediatrics. (1995), Treatment Guidelines for Lead Exposure in Children, Committee on Drugs, *Pediatrics*, 96(1):155-160. http://pediatrics.aappublications.org/content/96/1/155.full.pdf

American Academy of Pediatrics. (2005). Lead Exposure in Children: Prevention, Detection, and Management. *Pediatrics*, 116(4):1036-1046. http://pediatrics.aappublications.org/content/116/4/1036.full.pdf

American Academy of Pediatrics (2012, May 16). *AAP Commends CDC for Recognizing That for Children, There is No Safe Level of Lead Exposure* [*Press release]*. http://www.aap.org/en-us/about-the-aap/aap-press-room/Pages/AAP-Statement-CDC-Revised-Lead-Exposure-Guidelines.aspx

Centers for Disease Control and Prevention. (1997). *Screening Young Children for Lead Poisoning: Guidance for state and local public health officials*. Atlanta: CDC.

Centers for Disease Control and Prevention. (2002). *Managing Elevated Blood Lead Levels Among Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention*. Atlanta: CDC. http://www.cdc.gov/nceh/lead/CaseManagement/caseManage_main.htm

Centers for Disease Control and Prevention (2012, January 4), *Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention, Report of the Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention*. Atlanta: CDC. http://www.cdc.gov/nceh/lead/ACCLPP/Final_Document_030712.pdf

Centers for Disease Control and Prevention. (2012, June 7). *CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in "Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention."* Atlanta: CDC. http://www.cdc.gov/nceh/lead/ACCLPP/CDC_Response_Lead_Exposure_Recs.pdf

Rose, E. A., Porcerelli, J. H., & Neale, A. V. (2000). Pica: Common but Commonly Missed. *Journal of American Board of Family Practitioners*, 13(5):353-358.

Chapter 9

Nutrition and Childhood Lead Poisoning

Contents

Introduction 9.2

Lead Exposure from Water and Food 9.2

Nutrients and Eating Patterns Minimize Lead Absorption 9.3

Iron Deficiency and Lead Poisoning 9.4

Testing for Lead Poisoning and Providing Education in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC) 9.5

References 9.6

Wisconsin
Department of Health Services

(P-00660, 11/2014)

Introduction

Nutrition is an important factor in the prevention and treatment of lead poisoning. The nutrients received from certain foods and supplements play a role in minimizing absorption of ingested lead. Children with an adequate amount of calcium, iron, and zinc in their diets absorb less lead than children with dietary deficiencies. In addition, a compromised nutritional state makes one more susceptible to the damaging effects that result from increased absorption of ingested lead. For example, there is evidence that dietary deficiencies of calcium, iron and zinc enhance the effects of lead on cognitive and behavioral development. (Goyer, R. 1995)

In addition, adults who have calcium deficiency and simultaneously experience other conditions that would normally mobilize calcium from the bones may mobilize lead that has been stored in bone tissue into the blood. These conditions include essentially healthy and normal conditions such as pregnancy, lactation, menopause, and aging as well as conditions such as physiologic stress, broken bones, hyperthyroidism, kidney disease and other chronic diseases. For example, a pregnant woman who has a low dietary calcium intake may release stored lead from her bones into her blood, where it becomes available to the fetus. (See Chapter 11 for detailed information for pregnant and lactating women.)

Children with elevated blood lead levels are often at risk for poor nutrition, and their caregivers should receive nutritional counseling to help these children obtain a well-balanced and age-appropriate diet.

Lead Exposure from Water and Food

Water – Lead in water contributes about 10 to 20 percent of the total lead exposure for the average young child. Infants and young children may consume large quantities of water in formula and other liquids.

Lead levels in drinking water can increase when the water is heated and/or remains in contact with lead-containing plumbing for extended periods of time, especially in areas where water is corrosive (soft). Water can be the source of lead in reconstituted juices and beverages, and foods that are boiled or prepared using large amounts of lead-contaminated water.

Because of the volume consumed, formula made with lead-contaminated water is especially dangerous to infants. Steps should be taken to avoid using water that is: (1) first-draw morning water; (2) drawn from the hot water tap; (3) boiled longer than 10 minutes (causing lead to concentrate); and/or (4) boiled in lead-containing vessels.

To minimize lead exposure from water, use only water from the cold water tap. If tap has not been used for six hours or longer, run the tap water for two to three minutes or until icy cold before beginning formula or food preparation. If the lead level in tap water is of concern, bottled water should be used for mixing formula. If water for formula is boiled, boiling time should be limited to five minutes.

Lead contaminated water is rarely identified as a source of lead for Wisconsin children, where the primary source is deteriorated lead-based paint. However, to rule out lead as a source of exposure, water testing can be done through the Wisconsin State Laboratory of Hygiene (WSLH). Sampling kits can be ordered by calling the WSLH at 800-442-4618 or 608-224-6202.

Food Containers – Containers that contain lead can contaminate food that is cooked, stored or transported in the container. Lead-soldered cans, lead-glazed pottery, cracked or chipped pottery, and leaded crystal can all be sources of lead in food. The longer the food or beverage is exposed to a leaded container, the more contaminated it will become. Hot or acidic liquids also promote the leaching of lead from containers. In 1995 the U.S. banned the use of lead solder in food containers and regulates lead content in pottery glaze. However, imported foods or dishes may continue to be a source of lead contamination of food.

Supplements – Natural calcium supplements such as bone meal, oyster shells, and dolomite can also be contaminated with lead. Pregnant women should especially be cautious of these sources of calcium supplement. Several recent studies found that many commercially available calcium supplements do not meet acceptable limits for lead intake (less than 1 microgram of lead per day). Antacids and infant formulas had less lead contamination than other calcium supplements.

Herbal supplements may contain lead. A population based (NHANES) study of 6,712 women found that women who used herbal supplements had blood lead levels 10 percent higher than non-users; women of reproductive age (aged 16 to 45) who used herbal supplements had blood lead levels 20 percent higher than non-users (Buettner C., et al. 2009).

Soil – Lead can enter the food chain when vegetables and fruits are grown in soil that is contaminated with lead. Lead-contaminated soil is most often found next to old painted buildings, near roadways, near manufacturing and renewal/demolition sites, and in old orchards (from the use of fertilizers or pesticides containing lead). Leafy or root vegetables are more likely to be lead-contaminated than fruiting plants (Sharma et al, 2005, Spitler and Feder, 1979). Dust from sources such as remodeling, demolition, manufacturing and roadways can contaminate garden produce. If food preparation surfaces and foods are near such lead sources and are not protected from dust by covers or wrappings, they can also become lead-contaminated.

Lead from soil and dust can also be ingested by infants and very young children who mouth objects or their hands. It is normal, developmentally-appropriate behavior for children to put their hands and other objects in their mouths as they grow up. Careful handwashing before eating and after play can reduce potential lead exposure if the child lives in an older house with deteriorated paint, varnish or contaminated soil.

Nutrients and Eating Patterns Minimize Lead Absorption

The timing and types of nutrients in the diet can minimize absorption of ingested lead into a child's body. Adequate intake of certain vitamins and minerals, especially calcium, iron and vitamin C, beyond their requirement for overall good nutrition, can specifically minimize absorption of ingested lead (see Table 9.1).

Regular Meals and Snacks Decrease Lead Absorption – Stomachs that are full are less able to absorb lead. Gastrointestinal (GI) absorption of lead is three to four times greater during periods of fasting than during periods of feeding. Infants, young children, and pregnant women should consume well-balanced meals and snacks at regular intervals during waking hours to help minimize lead absorption. Infants and young children should be fed at least every three to four hours, or six smaller meals per day, to keep stomachs full and less likely to absorb lead.

Calcium – The more calcium a child consumes, the less of the ingested lead is retained by their body. Calcium and lead seem to compete for absorption in the GI tract and storage sites in the bones. Remobilization and subsequent elevation of blood lead levels occurs most readily when dietary calcium intakes are low and/or when calcium needs are increased, as during pregnancy, periods of bone growth, lactation, and following bone fractures. A combination of calcium and phosphorus in the diet further reduces lead absorption, making plant sources of calcium especially effective in minimizing lead absorption.

Iron – Iron deficient individuals absorb two to three times more lead than individuals with adequate levels of blood iron. Iron and lead interact and compete in heme synthesis. Even slight decreases in hematocrit allow increased lead absorption. In addition, more severe anemia occurs when blood lead levels reach approximately 40 mcg/dL. However, there is strong evidence that iron supplements are not effective at reducing lead levels once exposure has occurred (Rosado J., L., et al, 2006 and Gulson, B.,L., et al., 2006). See Chapter 8: Medical Management of Lead Poisoned Children for more information on diagnosing iron deficiency.

Vitamin C – Diets rich in Vitamin C enhance iron absorption and may decrease the absorption of lead. Decreased lead retention has been shown in rats fed Vitamin C and exposed to lead (Goyer and Cherian, 1979; Suzuki and Yoshida, 1979; Flora and Tandon, 1986) but less is known about children exposed to lead and benefitting from additional supplements of Vitamin C beyond what they get from an adequate diet (CDC, 2002).

Table 9.1. Adequate intake of these foods can help protect children from lead absorption and retention

Calcium	Milk, cheese, yogurt, kale, collards, turnip greens, canned salmon, sardines with bones
Iron	Lean meats and poultry, seafood, cereals and breads fortified with iron, peanut butter, nuts, dried beans and peas, raisins, prunes, prune juice, greens such as broccoli and spinach
Vitamin C	Tomatoes, oranges, grapefruits, juices, juices fortified with vitamin C, strawberries, kiwi, green peppers, watermelon, cantaloupe, potatoes

Iron Deficiency and Lead Poisoning

Iron deficiency can enhance lead absorption and often co-exists with lead poisoning. In addition, research indicates that iron deficiency in young children can be an independent neurotoxin, as well as enhancing the effects of lead poisoning on the central nervous system.

Adequate iron intake lowers lead absorption, and should be considered an essential secondary tool to protect children from absorbing lead they ingest from their environments. While the effect of lead on red blood cell production rarely occurs until BLLs reach approximately 40 mcg/dL, low iron stores promote absorption of lead at any blood lead level. Many U.S. children aged 1 to 2 have daily iron intake below recommended amounts. When exposed to lead hazards, these children may see the lasting effects on cognitive development due to both iron deficiency in infancy and the long lasting negative effects due to lead.

All children with BLLs $\geq$5 mcg/dL should be evaluated for iron deficiency. Serum iron and iron binding capacity are the tests of choice, as they are the most sensitive indicators of iron status.

If iron deficiency is diagnosed, treatment should begin along with treatment of the lead exposure. (*Note: Children receiving BAL (dimercaprol) as a chelating agent should not be treated for iron deficiency until the drug therapy is completed.)*

Testing for Lead Poisoning and Providing Education in the Special Supplemental Nutrition Program for Women, Infants and Children (WIC)

WIC clinics are opportune sites for blood lead testing and nutrition counseling related to lead poisoning. Wisconsin children who are enrolled in WIC have a higher prevalence of lead poisoning than children who are not enrolled. Children regularly receive capillary (fingerstick) blood tests for hematocrit or hemoglobin levels as part of the WIC certification process. Including a blood lead sample requires only a few more drops of blood. Because of the close tie between nutrition and lead poisoning, WCLPPP has worked closely with the Wisconsin WIC program and Wisconsin Medicaid Program to facilitate blood lead testing at WIC project sites. As a result, many local WIC projects in Wisconsin currently offer blood lead testing in partnership with the local health department and managed care organizations. It's important to note that federal WIC funds cannot be used to obtain blood lead tests. See Chapter 12 for information on Medicaid reimbursement for blood lead testing and Medicaid certification for WIC projects.

The WIC data system, ROSIE, includes fields for documentation of blood lead test results. WIC projects that perform blood lead tests must assure the test results are reported to the WCLPPP. See Chapter 5 for information on blood lead reporting requirements. WIC providers can request access to the Wisconsin Blood Lead Registry to assist in determining whether a child is in need of testing (see Chapter 5: Screening and Diagnosis).

The WIC nutrition education card series includes a card entitled "Eating Right: Preventing Childhood Lead Poisoning" [P-44968 (English) and P-44968S (Spanish)] that provides nutrition and other tips to decrease lead absorption. WIC and local health departments can order this card using a form requisition from the Department of Health Services Forms and Publications Center.

A publication from the Environmental Protection Agency, *Fight Lead Poisoning with a Healthy Diet,* can be ordered from the National Lead Information Center, 1-800-424-LEAD (5323). This pamphlet includes fun recipes for young children to encourage healthy eating.

References

Andrews, K.; Savitz, D.; Hertz-Picciotto, I. "Prenatal Lead Exposure in Relation to Gestational Age and Birth Weight: A Review of Epidemiologic Studies." *American Journal of Industrial Medicine* 26, 1994, 13-32.

Baldini, M.; Coni, E.; Mantovani, A.; Stacchini, A.; Zanasi, F. "Effect of Unbalanced Diets on Long Term Metabolism of a Toxicant 1. Lead in Rats: Preliminary Note." *Food Add and Contaminants* 6 (1), 1989, 117-124.

Bourgoin BP, Evans DR, et al. "Lead Content in 70 Brands of Dietary Calcium Supplements." American Journal of Public Health August 1993; (83):1155-1160.

Butte NF, Fox MK, Briefel RR et al. "Nutrient intakes of US infants, toddlers and preschoolers meet or exceed dietary reference intakes." J. Am. Diet. Assoc. December 2010; (110)(12 Suppl):S27-37.

Centers for Disease Control and Prevention. Managing elevated blood lead levels among young children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention, 2002.

Flora, SJS, Tandon, SK. Preventive and therapeutic effects of thiamin, ascorbic acid and their combination on lead intoxication. Acta Pharmacol Toxicol, 1986:58:374-8.

Frisancho, A. R.; Ryan, A. S. "Decreased Stature Associated With Moderate Blood Lead Concentrations in Mexican American Children." *American Journal of Clinical Nutrition*. 54 (3), September 1991, 516-519.

Goyer, RA, Cherian, GM. Ascorbic acid and EDTA treatment of lead toxicity of rats. Life Sci 1979,24:433-8.

Goyer, RA, (1995) Nutrition and metal toxicity. American Journal of Clinical Nutrition. 61 (supplement), 646s-650s.

Gulson, B., L., Mizon, k., J., Korsch, M., J., Taylor, A., J. (2006) Low Blood Lead Levels Do Not Appear to Be Further Reduced by Dietary Suppplements. *Environmental Health Perspectives*. 114, 8, 1186-1192.

"Lead in 'Natural' Calcium Pills Still Causes Concern." *Tufts Univ Diet Nutr Letter*. 5 (9), November 1987, 2.

Lucas, S.; Sexton, M.; Langenberg, P. "Relationship Between Blood Lead and Nutritional Factors in Preschool Children: A Cross-Sectional Study." *Pediatrics* 97(1), 1996, 74-78.

Mahaffey, K. "Environmental Lead Toxicity: Nutrition as a Component of Intervention." *Env Health Pros.* 89, 1990, 75-78.

Mahaffey, K. "Nutrition and Lead: Strategies for Public Health." *Env Health Perspectives* 103 (Suppl 6), 1995, 191-196.

"The Pollutants That Matter Most: Lead, Radon, Nitrate." *Consumer Report. Consumer Union U.S.* 55 (1), January 1990, 30-32.

Rehman S, Adnan M, Khalid N, Shaheen L. Calcium supplements: an additional source of lead contamination. Biol Trace Elem Res Oct 2011; (143):178-187.

Reichlmayr Lair, A.M.; Kirchgessner, M. Edited by Earl Friedman. "Lead." *Biochemistry of the Essential Ultratrace Elements*. New York, NY: Plenum Press, 1984, 367-387.

Rosado, J., L., Lopez, P., Kordas, K., Garcia-Vargas, G., Ronquillo, D., Alatorre, J., Stoltzfus, R., J. Iron and/or Zinc Supplementation Did Not Reduce Blood Lead Concentrations in Children in a Randomized, Placebo-Controlled Trial. (2006) *Journal of Nutrition*. 136, 2378-2383.

Ross EA, Szabo NJ, Tebbett IR. "Lead Content of Calcium Supplements." Journal of American Medical Association Sept 20, 2000; 284(110):1425-1429.

Sargeant, J. "The Role of Nutrition in the Prevention of Lead Poisoning in Children." *Pediatric Annals* 23, November 1994, 636-642.

Scelfo GM, Flegal AR. "Lead in Calcium Supplements". Env Health Perspectives. 2000 April;108(4):309-13

Schwartz, J.; Angel, C.; Pitcher, H. "Relationship Between Childhood Blood Lead Levels and Stature." *Pediatrics* 77 (3), March 1986, 281-288.

Shannon, M.; Graef, J. W. "Lead Intoxication: From Lead-Contaminated Water Used to Reconstitute Infant Formula." *Clin Pediatr*. 28 (8), August 1989, 380-382.

Sharma P and Dubey RS. "Lead Toxicity in Plants." Brazilian Journal of Plant Physiology March 2005.(17) pp.35-52.

Spittler TM, Feder WA. "A study of soil contamination and plant lead uptake in Boston urban gardens." Commun. in Soil Science and Plant Analysis 1979; (10)9:115-1210.

Suzuki, T, Yoshida. Effect of dietary supplementation of iron and ascorbic acid on lead toxicity of lead in rats. J Nutr 1979;109:982-8.

Tarrago O, Demers R. Case Studies in Environmental Medicine, Lead Toxicity. Agency for Toxic Substances and Disease Registry. US Dept of Health and Human Services. August 2010.

Watson, W. S.; Morrison, J.; Bethel, M. I. F.; Baldwin, N. M.; Lyon, D.T. B.; Dobson, H.; Moore, M. R.; Hume, R. "Food Iron and Lead Absorption in Humans." *An J Clin Nutr.* 44 (2), August 1986, 248-256.

Yip, R. "Iron Deficiency and Childhood Lead Poisoning." *Functional Significance of Iron Deficiency.* Ed. Cyril O. Enwonwo. Meharry Medical College, Fall 1990.

Chapter 10

Developmental Assessment and Intervention for a Child with Lead Exposure

Contents

In Brief: Summary of Recommendations for Developmental Assessment and Intervention 10.2

Introduction 10.3

Effects of Low Level Lead Exposure on Cognitive Development 10.4

Factors Affecting Risk of Developmental Effects 10.6

Developmental Surveillance as a Long-Term Health Intervention 10.6

Agencies Involved in Responding to a Child with Early Lead Exposure 10.7

References 10.9

Wisconsin
Department of Health Services

(P-00660, 11/2014)

In Brief: Summary of Recommendations for Developmental Assessment and Intervention

For an Individual Child

1. Make long-term developmental surveillance a component of the management plan for any child with lead exposure of 5 mcg/dL or greater.
2. Do not base decisions regarding developmental assessment or intervention on a child's age at the time of the lead exposure.
3. If referring a child for intervention services, e.g., early intervention and stimulation programs, it is recommended that a parent skills development component be included.
4. Include a history of a child's lead exposure in the problem list maintained in the child's medical record.
5. Do not end developmental surveillance when the child reaches 6 years of age or when his/her BLLs are reduced, but continue as the child ages.
6. Be especially vigilant for emerging difficulties at critical transition points in childhood: first, fourth and six to seventh grades.
7. Be alert for behaviors that might interfere with learning.
8. If neurodevelopmental problems are suspected in a child, refer for a thorough diagnostic evaluation (as opposed to a developmental screening test).
9. Be an advocate for the child.

For State and Local Childhood Lead Poisoning Prevention Programs (CLPPPs)

1. Educate parents and health care providers about the need for vigilance in the period following a test result and at critical transition points in educational expectations such as first, fourth and sixth grades, and about the merits of accepting a referral to early intervention programs.
2. Develop interagency agreements to provide the names of children with blood lead above the reference value to the Child Find systems (see page 10.6) for Part C (early intervention services for children under 3) and to the local education agency including Part B (special education for children 3 and above).
3. Add referral to Child Find for Part C early intervention services to their case management protocol and track enrollment results.
4. Develop a system for making contact with families to ensure that they are referred to Early Childhood Enrichment and in-school programs at the time the child becomes eligible (3rd birthday and the year the child reaches school age) even if the child has been discharged from lead case management.
5. Enlist the Child Find agency and early intervention service providers in the screening and surveillance effort so that children identified through those systems and their siblings are screened.
6. Help the Child Find agency and local education agencies target outreach and services to children most likely to have blood lead levels above the reference value.

Introduction

Research on the effects of lead on the neurodevelopment of children has made clear that there is no “safe” level of lead in the human body, especially for young children. Both prospective and retrospective studies have found a link between high blood lead levels (BLLs) and cognitive and behavioral deficits in children. Research shows a strong relationship between early childhood lead exposure and decreased learning proficiency (see Table 10.1). In May 2012, the CDC accepted the recommendations of its advisory committee to lower the reference value to 5 mcg/dL. This decision was based on the large body of research showing effects of lead exposure on children at BLLs below 10 mcg/dL.

Table 10.1 Research Summary on Childhood Lead Exposure and Later Educational Proficiency

Study	Consequences of Lead Exposure on Educational Outcomes
Amato et al., 2012, 2013, Milwaukee, Wisconsin, fourth-grade students	Significantly lower academic performance test scores Rate of three to one more likely to be suspended
Evens et al., 2013, Chicago, Illinois, third- grade students	Lower reading and math test scores
McLaine et al., 2013, Providence, Rhode Island Kindergarten students	Reading readiness scores were 4.5 to 10 points lower
Miranda et al., 2009, 2010, Raleigh, North Carolina fourth-grade students	More likely to score lower on end-of-grade tests Less likely to be placed into advanced and intellectually gifted programs More likely to be classified as learning disabled
Miranda et al., 2011, Connecticut fourth- grade students	Decreased achievement on math and reading tests
Strayhorn and Strayhorn, 2012, New York third- and eighth- grade students	Explained 8 to 16 percent of the variance in reading and math scores adjusting for poverty Using test scores from third grade to eighth grade, scores predictive of lower test performance
Zhang et al., 2013, Detroit students in third, fifth and eighth grades	1.4 to 2.5 times more likely to be non-proficient in math, science and reading

Children with BLLs at or above 5 mcg/dL are at greater risk for developmental delays and behavioral issues that can result in academic failure and diminished life success compared to children who do not have a history of lead exposure. It is important that all children with lead exposure be screened for adverse neurocognitive effects using neuropsychological evaluation tools that provide a complete assessment to identify the complex subsystems in the brain that work differently when affected by lead. This assessment is critical for determining a child’s specific detriments and to identify the most appropriate early interventions or elementary school interventions that are necessary.

Connecting lead-exposed children to early intervention programs is key. An effective intervention program utilizes strategies that are proven to help children with brain dysfunctions similar to those experienced by a lead-poisoned child.

Effects of Low Level Lead Exposure on Cognitive Development

The association of higher BLLs (20 mcg/dL or greater) and impaired cognitive development and aggressive behavior have been known for several decades. Recent studies on the effects of low-level lead exposure have employed protocols that include finer grain assessments of cognitive, language, memory, sensory and neuromotor abilities, uncovering mechanisms by which lead damages the development of these abilities.

Low-level lead exposure experienced during the development of the brain of a young child has been found to be connected to:

- Deficits in IQ.
- Attention difficulties and hyperactivity.
- Speech and language delays.
- Fine and gross motor skills dysfunction.
- Visual-spatial skills impairment.
- Social behaviors, such as impulsivity and aggression.
- Executive function disabilities.

Low Level Exposure Effects Noted in Wisconsin Children

- In 2001, 34% of children with EBLLs and documented developmental screening tests were noted to have some behavioral, psychosocial, language, motor, or cognitive delays at the time the EBLL was diagnosed.
- 98% of those children with a noted developmental delay had speech and language delays.
- In 2012-13, studies found that children in Milwaukee who had been lead exposed prior to the age of 3

Overall, the literature strongly suggests that early childhood exposure to lead affects central nervous system substrates and behaviors that are best measured in the older child, adolescent, and young adult. This “lag” may be the result of toxicological processes in which some period of time is required for past lead exposure to affect central nervous system function. Another explanation is that lead may primarily affect higher-order neurodevelopmental processes that are best tested or only measureable at later ages when children’s response modalities are more highly differentiated (e.g., the *executive functions* discussed earlier).

One implication of this lag is that neurodevelopmental assessments conducted in young children when a child has an EBLL may fail to identify a child who is at risk for later neurodevelopmental dysfunction. Careful long-term surveillance of behavior and neurodevelopment of children with BLLs greater than or equal to the reference value is thus needed to ensure that these impacts are identified should they appear in the future. The effects of lead exposure on the skills required for academic success and optimal adjustment may not manifest until a child reaches critical transition points in school and the larger social environment. Each of these transition points may present special physical, emotional, social and academic challenges to the lead-poisoned child. The challenges that arise after each transition are described in Table 10.2.

Table 10.2 Expectations of Learner and Impact of Lead Exposure on the Learner

Phase of Learning	Expectations in a Learning Setting	Outcomes of Lead Exposure
Preschool	• Sit quietly for short periods of time • Listen and follow directions • Share supplies, activities, and attention • Relate and adapt to a new set of peers and adult caregivers • Develop listening, attention and memory skills in the context of learning	• Inability to sit still • Decreased hearing function and ability to discriminate sounds • Immature social skills • Short attention span • Difficulty in memorizing new concepts
Early Elementary	• Adjust to a longer and more structured school day • Develop the ability to understand and complete assignments and homework • Face more objective rewards and consequences for their behavior • Develop broader social networks and cooperative working skills • Acquire basic academic skills such as reading words and short stories for meaning, performing arithmetic operations, and answering questions	• Less likely to reach proficiency in reading, arithmetic, science, and social studies • More likely to be suspended from school
Upper Elementary	• Become more independent in the face of increased physical, social and academic demands • Use basic skills to acquire information and solve problems • Expand social networks (may experience isolation and bullying) • Participate in competitive and team sports • Accept one's own and peers' skills and limitations	• Impaired by poor language skills and attention deficits • More likely to experience difficulty making the transition from "learning to read" to "reading to learn" to learn new material • Less likely to participate in sports due to unstable coordination and other neuromuscular skills
Middle School	• Adapt to a more formal and impersonal academic structure with a number of teachers with different teaching styles and expectations • Requires more independence to develop and utilize higher order cognitive and organizational skills • Master several unrelated classes and assignments • Experience mounting social pressures and need for peer acceptance	• Less likely to attain higher order cognitive and organizational skills. • More likely to drop out of school, become pregnant, and commit violent crime
High School	• Adapt to a greater number of students and teachers and a more rigorous academic and disciplinary environment • Establish new peer networks and achieve greater independence from family • Balance school and part-time employment • Withstand pressure to experiment with alcohol, drugs, and sexual activities • Develop a more assertive, focused and efficient learning style and apply good study and organizational skills • Make decisions regarding vocation and further education beyond high school	• Less likely to attain higher order cognitive and organizational skills. • More likely to drop out of school, become pregnant, and commit violent crime

Some lead-poisoned children may lack the physical, social, and cognitive skills to cope with the challenges posed by these critical transition periods. Evidence of this comes from literature in the form of a long-term follow-up study of Massachusetts children. After controlling for other sociodemographic factors, in this study, the persistent toxicity of lead – as measured in shed deciduous teeth harvested from asymptomatic children – was directly associated with serious impairments in academic success, including a seven-fold increase in failure to graduate from high school, lower class standing, greater absenteeism, and impairment of reading skills, as compared to the group with lowest teeth lead (Needleman et al. 1990).

Factors Affecting Risk of Developmental Effects

There is variability in the effects of lead at various levels on different children. Because of this, it is recommended that lead exposure should be viewed as a risk factor for neurodevelopmental problems, not a diagnosis. Elevated blood lead levels (5 mcg/dL or greater) in a child's medical history should trigger alertness to the potential for learning and behavioral difficulties.

Children most at risk of lead poisoning are often from families living in poverty and have other risk factors for neurodevelopmental delays, including poor nutrition, poor sleep patterns, being transient, lack of regular health care, lack of cognitive stimulation, and living in a single-parent household. For these children, lead poisoning becomes another factor that may inhibit them from reaching their full potential.

Modifications in the child's environment may help mitigate some of the effects of lead poisoning. While there is no specific evidence that early intervention will prevent or diminish the effects of lead poisoning, it is reasonable to hypothesize that children whose neurodevelopmental difficulties are caused by lead poisoning would be helped by interventions that have been shown to assist children with difficulties caused by other etiologies. For those children, participation in early intervention programs is associated with lower rates of grade retention and decreased need for special education.

Evidence suggests that participation in such programs is enhanced if begun prior to age 3, and if the program has a partnering component for developing parenting skills. Because lead exposure is one of the multiple etiologies that can cause developmental delays, referral to such early intervention programs becomes an important piece of case management or medical management of a child with lead poisoning. It may benefit the child to have a referral to such programs even if no delays are noted at the present time.

Developmental Surveillance as a Long-Term Health Intervention

Ongoing developmental surveillance should be included in the long-term management plan for a child with a history of lead poisoning. A decrease in the child's BLL should not be used as an indicator that long-term developmental surveillance is no longer necessary.

The health care provider should be alert to any current or developing behaviors that may interfere with learning and advocate for the child to receive the appropriate developmental assessment and supportive services. This may result in a multi-disciplinary team being involved to identify delays and needed services, possibly including Birth to 3 programs, Child Find agencies, local education agencies (LEAs), Early Childhood Enrichment (ECEs) programs and Children and Youth with Special Health Care Needs (CYCSHN) referral centers. Coordination within this team will be important, and the family will need explanation and leadership in guiding

them through the process. Financial assistance may also be required to obtain the services that are needed. Assistance in this area may be available through the Wisconsin CYSHCN Program and referral centers. Contact the Wisconsin First Step Hotline (800-642-7837) or http://www.mch-hotlines.org for more information.

Professionals in the fields of early intervention, early childhood, and elementary and secondary education need information from lead poisoning prevention programs and health care providers to ensure that they understand and fulfill their unique roles. Affected children may exhibit little to no development difficulty early in life but begin to exhibit learning delays at later transition points. Behavioral difficulties may also become apparent as the child ages when there are higher expectations for self-regulation and interpersonal skills. Listed at the beginning of this chapter are recommendations for interagency collaboration to provide assessment and intervention to serve children and their educational needs.

Agencies Involved in Responding to a Child with Early Lead Exposure

Child Find – Federal regulations require that each state have a "comprehensive child find system" with the purpose of identifying, locating, and evaluating, as early as possible, all infants and toddlers birth to age three with disabilities. The Child Find system has the authority and duty to refer children with disabilities or risk conditions, such as children who have had a blood lead level above the reference value, to needed early intervention services. Services that may be included in this program are family training, counseling, home visits, speech-language services, occupational therapy, physical therapy, and others. Parents concerned about their child's development may request a screening at no cost through Child Find. Pediatricians or school personnel often refer children for screening, which requires parental permission to conduct.

This link will provide more information about how Child Find works in Wisconsin. There is also a referral hotline (800-642-7837) called Wisconsin First Step staffed by parent specialists with disability expertise and a child with a special need.

Local Education Agencies – Local Education Agencies (LEAs), i.e., school districts and charter schools, are responsible for compliance with Child Find. School district offices or websites can provide contact information for the personnel responsible for screening and referrals through Child Find. These agencies are also required to coordinate with other agencies responsible for relevant education, health, and social service programs, specifically including the Maternal and Child Health program (including the Maternal, Infant, and Early Childhood Home Visiting Program), the Early Periodic Screening, Diagnosis, and Treatment (EPSDT) component of Medicaid, Head Start and Early Head Start, Supplemental Security Income programs, and other appropriate programs.

Early Childhood Enrichment – Early childhood enrichment (ECE) programs, including the Head Start program, have been shown to benefit both typically developing children and children with disabilities, as well as benefitting the parents of enrolled children. In a review of early childhood education programs enrolling typically developing children, researchers found that "within the cognitive domain, consistent improvements were found in measures of intellectual ability (IQ), standardized tests of school readiness, promotion to the next grade level, and decreased placement in special education classes because of learning problems" (Anderson et al., 2003).

Among the range of ECE programs, the Head Start program has been shown to have modest measurable effects on enrolled children. Head Start is differentiated from the traditional ECE program in that it focuses on children's health, nutrition, mental health and social service needs in addition to education and inclusion of children with disabilities. This focus on the whole child is designed to mitigate social and economic factors that may limit a young child's ability to learn in the classroom.

Wisconsin Early Education Initiatives
Wisconsin has a number of initiatives to enhance the social emotional development of children and families in need:

- Wisconsin Collaborating Partners (website)
- Wisconsin CESAs for Serving Children with Disabilities (contacts)
- Wisconsin Pyramid Model for Social Emotional Competence (website, video overview)
- Wisconsin Positive Behavioral, Interventions and Supports (PBIS) Network
- Wisconsin Family Assistance Center for Education, Training and Support (WI FACETS)
- Wisconsin Supporting Families Together Association (SFTA)

Children and Youth with Special Health Care Needs – For over 75 years, the Federal Title V Maternal and Child Health program has provided a foundation for ensuring the health of the nation's mothers, women, children and youth, including children and youth with special health care needs, and their families. The Maternal and Child Health Block Grant to States programs may look different from state to state but are required to provide services to help parents with diagnosis and follow-up of any health, development and learning concerns. In Wisconsin, the CYSHCN program has regional resource centers that can be accessed to provide information and support to families of lead-exposed children as the child enters elementary school and beyond.

For information: Children and Youth with Special Health Care Needs regional centers across Wisconsin.

References

Amato M, Moore CF, Magzamen S, Imm P, Havlena JA, Anderson HA, Kanarek MS. Lead exposure and educational proficiency: moderate lead exposure and educational proficiency on end-of-grade examinations. Annals of Epidemiology 2012; 22:738-743

Amato MS, Moore CM, Magzamen S, Imm P, Havlena JA, Anderson HA, Kanarek MS. Early lead exposure less than 3 years old prospectively predicts fourth grade school suspension in Milwaukee, Wisconsin. *Environmental Research* 2013; 126: 60-65.

Anderson, LM, Shinn, C, Fullilove, MT, Scrimshaw, SC, Fielding, JF, Normand, J. Carande-Kulis, V.G., and the Task Force on Community Preventive Services (2003). The effectiveness of early childhood development programs: A systematic review. *American Journal of Preventive Medicine,* 24(3S), 32-46. doi:10.1016/S0749-3797(02)00655-4

Bellinger, D, Stiles, K, and Needleman, H. "Low Level Lead Exposure, Intelligence and Academic Achievement: A Long Term Follow-Up Study." Pediatrics. 90, 6 p. 855-861 December 1992.

Centers for Disease Control and Prevention, *Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention,* Report of the Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention, January 4, 2012 (http://www.cdc.gov/nceh/lead/ACCLPP/Final_Document_030712.pdf)

Centers for Disease Control and Prevention; *CDC Response to Advisory Committee on Childhood Lead Poisoning Prevention Recommendations in "Low Level Lead Exposure Harms Children: A Renewed Call of Primary Prevention,"* June 7, 2012 (http://www.cdc.gov/nceh/lead/ACCLPP/CDC_Response_Lead_Exposure_Recs.pdf)

Centers for Disease Control and Prevention, "Managing Elevated Blood Lead Levels Among Young Children," March, 2002. (http://www.cdc.gov/nceh/lead/CaseManagement/caseManage_main.htm)

Evens A, Hryhorczuk D, Lanphear B, Lewis D, Forst L, Rosenberg D. *The Effect of Childhood Lead Exposure on School Performance in Chicago Public Schools*. Forthcoming work. Chicago, IL: University of Illinois at Chicago.22. U.S. Department of Education. 34 CFR Parts 300 and 301. Assistance to States for the Education of Children with Disabilities and Preschool Grants for Children with Disabilities. Available at: http://idea.ed.gov/download/finalregulations.pdf. Accessed June 4, 2012.

Lanphear, B, Dietrich, K, Auinger, P, Cox, C. *"Cognitive Deficits Associated With Blood Lead Concentrations <10mcg/dL in US Children and Adolescents,"* Public Health Reports, Vol. 115, November/December 2000.

Lidskya TI and Schneiderb JS. Adverse effects of childhood lead poisoning: The clinical neuropsychological perspective Environmental Research 2006;100:284–293.

McLaine P, Navas-Acien A, Lee R, Simon P, Diener-West M, Agnew J. Elevated Blood Lead Levels and Reading Readiness at the Start of Kindergarten. Pediatrics 2013;131:1081–1089.

Magzamen S, Imm P, Amato, M, Havlena, J, Anderson, HA, Moore C, Kanarek M. Moderate lead exposure and elementary school end-of-grade exam performance. *Annals of Epidemiology* 2013; 23(1): 700-707.

Miranda ML, Maxson P, Kim D. Early childhood lead exposure and exceptionality designations for students. *Int J Child Health Hum Dev*. 2010;3(1):77–84.

Miranda ML, Kim D, Reiter J, Overstreet Galeano MA, Maxson P. Environmental contributors to the achievement gap. *Neurotoxicology*. 2009;30(6):1019–1024.

Miranda ML, Dohyeong K, Osgood C, Hastings C. *The Impact of Early Childhood Lead Exposure on Educational Test Performance among Connecticut Schoolchildren, Phase 1 Report*. Durham, NC: Children's Environmental Health Initiative, Duke University; 2011.

Strayhorn JC and Strayhorn JM. Lead exposure and the 2010 achievement test scores of children in New York counties Child and Adolescent Psychiatry and Mental Health 2012; 6:4

Zhang N, Baker HW, Tufts M, Raymond RE, Salihu H, Elliott MR. Early Childhood Lead Exposure and Academic Achievement: Evidence From Detroit Public Schools, 2008–2010. AJPH 2013;113:e72-e77.

Chapter 11

Lead Toxicity and Reproductive Health, Pregnant and Lactating Women, and Fetal and Infant Development

Contents

In Brief: Summary of Public Health Actions on Maternal and Infant Blood Lead Levels (CDC, 2010) 11.2

Introduction 11.3

Lead Toxicity and Reproductive Health 11.3

Effects on Fetal and Infant Growth and Neurodevelopment 11.4

Prenatal Assessment and Intervention 11.6

Key Recommendations to Prevent or Reduce Lead Exposure 11.7

Blood Lead Testing in Pregnancy and Early Infancy 11.7

- Follow-up Blood Lead Testing for Pregnant and Lactating Women and Infants 11.7

Recommended Actions for Pregnant and Lactating Women with Lead Exposure 11.9

Breastfeeding and Lead Exposure 11.10

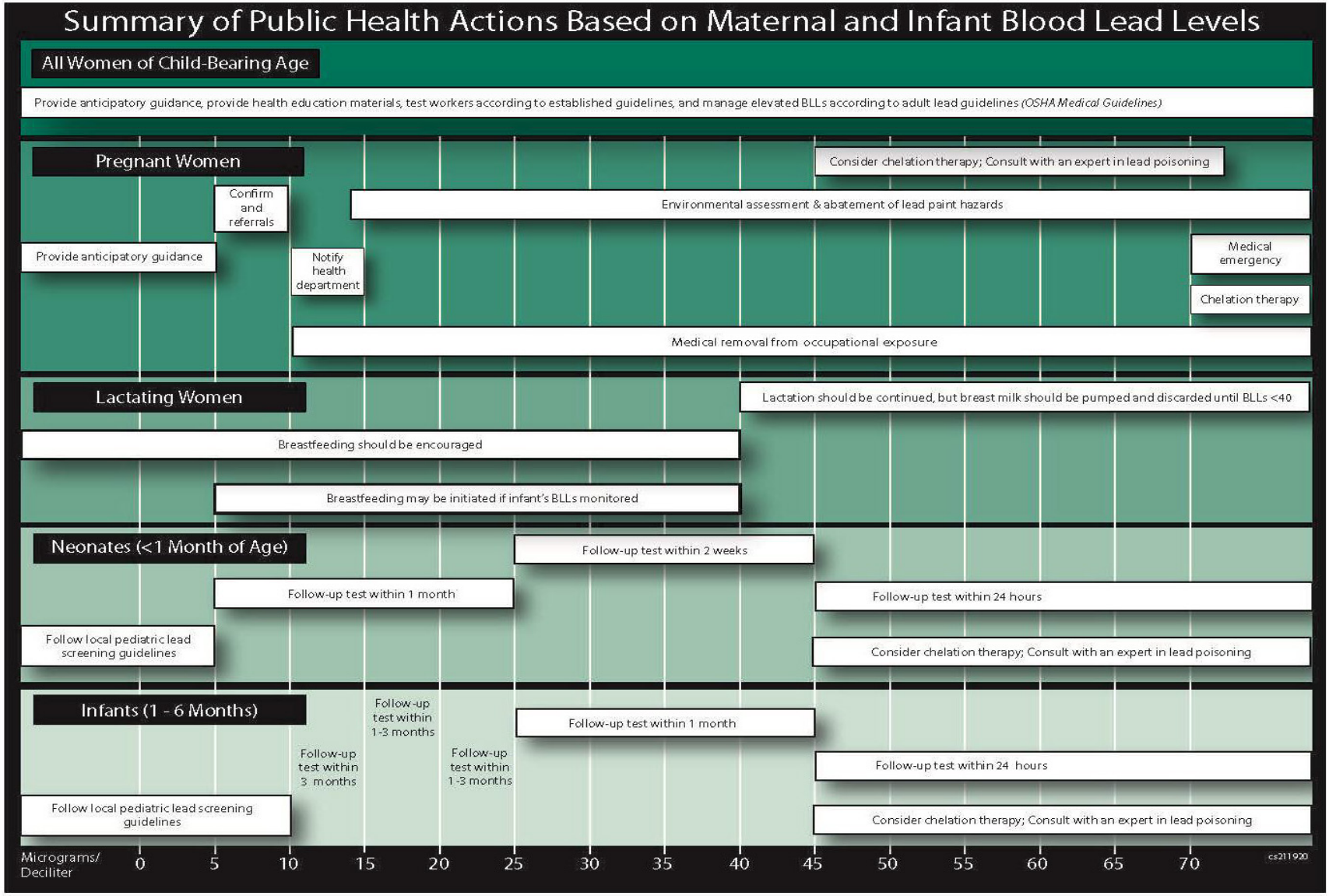
- Lead in Breast Milk 11.10
- Infant Dose of Lead from Breast Milk 11.11
- Recommendations for Lactating Women with Lead Exposure 11.12

References 11.14

Wisconsin Department of Health Services

(P-00660, 11/2014)

In Brief: Summary of Public Health Actions on Maternal and Infant Blood Lead Levels (CDC, 2010)



Introduction

Lead is ubiquitous in the human environment as a result of industrialization. Lead has no known physiologic value, and has long been recognized as a reproductive toxin in both men and women. Despite improvements in environmental policies and significant reductions in U.S. average blood lead levels, lead exposure remains a concern for pregnant and lactating women, particularly among certain population subgroups at increased risk for exposure.

Recent National Health and Nutrition Examination Survey (NHANES) estimates suggest that almost 1 percent of women of childbearing age (15-44 years) have blood lead levels greater than or equal to 5 mcg/dL (Centers for Disease Control and Prevention 2008, unpublished data). There exists good evidence that maternal lead exposure during pregnancy can cause fetal lead exposure and can adversely affect both maternal and child health across a wide range of maternal exposure levels. Maternal lead exposure and lead poisoning history should be considered in prenatal care assessments.

Over 90 percent of lead in the adult body is stored in bones and teeth, and the remaining lead is stored in blood and soft tissue. Lead stored in bones has a long half-life (20-30 years) and can be mobilized into blood and soft tissues during periods of heightened bone turnover, such as pregnancy and lactation, and can adversely affect the fetus or newborn. Women and their infants may be at risk for continued exposure long after exposure to external environmental sources has been terminated. Lead is similar in chemical structure to calcium, and competes with it for absorption in the gastrointestinal tract and deposition in bone.

Today, the workplace is often the source of lead exposure for adults. Toxic BLLs should not occur if workplace exposures are in compliance with Occupational Safety and Health Administration (OSHA) regulations. For more information on workplace exposure and adult blood lead poisoning, contact the Bureau of Environmental and Occupational Health, Wisconsin Division of Public Health (608-264-9829) or OSHA at www.osha.gov.

In November 2010, CDC issued guidelines for the identification and management of lead exposure in pregnant and lactating women. Some of the most salient of the guidelines are included in this chapter – effects of lead on reproductive health, pregnancy and lactation and the fetus and newborn, health actions, and initial and follow-up testing schedules for pregnant and lactating women and their infants.

Lead Toxicity and Reproductive Health

For centuries, exposure to high concentrations of lead has been known to pose health hazards. Recent evidence suggests that chronic low level lead exposure also has adverse health effects in both adults and children and no blood lead threshold level for these effects has been identified. CDC has not identified an allowable exposure level, level of concern, or any other bright line intended to connote a safe or unsafe level of exposure for either mother or fetus. Instead, CDC is applying public health principles of prevention to intervene when prudent (see Public Health Actions at the beginning of this chapter).

In adult males, chronic lead exposure can result in decreased sex drive, impotence, and sterility (Rodamilans et al. 1988). Abnormalities in sperm, including count and motility, have also been found. There is no consistent evidence that male lead exposure gives rise to negative effects on a fetus (Jensen et al., 2006).

Lead may adversely impact sexual maturation in the developing female and may reduce fertility. Although studies are limited, there is some suggestion that blood lead at relatively low levels may lead to alterations in onset of sexual maturation (Wu et al., 2003) and reduced fertility (Guerra-Tamayo et al., 2003). These findings underscore the importance of considering sensitive markers of human reproductive ability in relation to lead exposure.

Maternal lead exposure during pregnancy has been linked to both gestational hypertension and preeclampsia. In a review article (Kennedy et al. 2012) researchers found positive associations between lead exposures in pregnant women and the development of preeclampsia in two studies of mothers whose median blood lead levels were greater than 10 mcg/dL. Among pregnant women with blood lead levels less than 10 mcg/dL, no association between maternal blood lead and preeclampsia was found (Rabinowitz et al., 1987).

In contrast, hypertension seems to begin developing at lower blood lead levels. Among pregnant women with lower blood lead levels (median less than 10 mcg/dL), increasing blood lead levels were predictive of increased probability of developing gestational hypertension in two out of three studies. Studying pregnant women with higher blood lead levels, median greater than 10 mcg/dL, researchers found a significantly increased prevalence of hypertension (Magri et al., 2003, Sowers et al., 2002, Vigeh et al., 2004).

The evidence suggests that increased risk for spontaneous abortion appears to be associated with blood lead levels ≥30 mcg/dL (Borja-Aburto et al., 1999, Lamadrid-Figueroa et al., 2007). There is limited evidence to suggest that maternal blood lead levels less than 30 mcg/dL are associated with an increased risk for spontaneous abortion. Maternal lead exposure may increase the risk for preterm delivery (Torres-Sanchez et al., 1999, Jelliffe-Pawlowski, 2006), lower birth weight (Gonzalez-Cossio et al., 1997, Zhu et al., 2010), shorter birth length and smaller head circumference (Hernandez-Avila et al., 2002, Rothenberg et al., 1999). The available data are inadequate to establish the presence or absence of an association between maternal lead exposure and major congenital anomalies in the fetus (Jackson et al., 2004).

Effects on Fetal and Infant Growth and Neurodevelopment

Both pregnancy and breastfeeding can cause a state of physiologic stress that increases bone turnover of lead. Lead stored in the bone as a result of childhood lead poisoning can move into the blood, increasing the mother's blood lead level and passing to the fetus. Pregnancy-related hormonal changes affect calcium metabolism and can also cause lead to leave the bone and enter the blood. Thus, women's blood lead levels typically rise during pregnancy.

Lead binds tightly to red blood cells, enhancing transfer from maternal circulation through the placenta to the fetus. Placental transfer begins as early as the 12th week of gestation. As in adults, the lead can be found in fetal blood, soft tissue, and bone. The fetus is more sensitive to lead because the fetal blood-brain barrier is more permeable, the developing central nervous system is more vulnerable, and the fetus has less bone tissue for sequestering lead. Fetal exposure to lead is usually determined by measuring lead from umbilical cord blood samples taken at birth. These samples are highly correlated with maternal blood levels, with fetal BLLs estimated to be 80 to 90 percent of the maternal levels.

Because elevated maternal blood lead is available to the fetus, it can negatively impact fetal development. Lead is known to interfere with synaptogenesis and, perhaps, with pruning (Goldstein, 1992) in the developing brain. It interferes with stimulated neurotransmitter release

at synapses in the cholinergic, dopaminergic, noradrenergic, and GABAergic systems (Cory-Slechta, 1997; Guilarte et al., 1994). It substitutes for calcium and zinc as a second messenger in ion-dependent events. These disturbances in neurotransmitter release would thus be expected to disrupt the normal organization of synaptic connections (Bressler and Goldstein, 1991).

The brain is protected from large molecular compounds in the blood by the blood-brain barrier, created by tight junctions between endothelial cells in cerebral blood vessels (Goldstein, 1990). The development of this barrier function begins *in utero* and continues through the first year of life (Goldstein, 1990). The brain is one of the target organs for lead. Lead exposure *in utero* and during the first year of life may disrupt the development of the blood-brain barrier.

Evidence is clear that in utero exposure to low levels of lead can affect infant and child growth and neurodevelopment. More recent prospective studies have included children with lower prenatal exposures, and continue to detect inverse associations with neurodevelopment.

- Wasserman et al., (2000) found independent adverse effects of both prenatal and postnatal blood lead on IQ among Yugoslavian children aged 3-7 years. Prenatal lead exposure was associated with a deficit of 1.8 IQ points for every doubling of prenatal maternal blood lead after controlling for postnatal exposure and other covariates.
- In a study conducted in Mexico City, Gomaa et al., (2002) found that umbilical cord blood lead and maternal bone lead levels were independently associated with covariate-adjusted scores at 2 years of age on the Mental Development Index score of the Bayley Scales of Infant Development with no evidence of a threshold.
- Maternal blood lead level early in the second trimester and in the third trimester was a significant predictor for some measures of mental and psychomotor development at age 2 years (Wigg et al., 1988).
- In another study in Mexico City, maternal plasma lead level in the first trimester was a particularly strong predictor of neurodevelopment at age 2 (Hu et al., 2006). When this cohort was assessed at 24 months, inclusion of umbilical cord blood lead level in the model indicated that it was a significant predictor of psychomotor development even when analyses were restricted to children whose did not exceed 10 mcg/dL (Tellez-Rojo et al., 2006).
- Schnaas et al. (2006) found that prenatal lead exposure around 28-36 weeks gestation (third trimester) was a stronger predictor of reduced intellectual development at ages 6–10 years than second trimester (12-20 weeks) exposure, but that study did not measure prenatal exposure in the first trimester of pregnancy.
- Jedrychowski et al. (2008) found a higher risk of scoring in the high-risk group on the Fagan Test of Infant Intelligence at age 6 months when umbilical cord blood was higher.
- Low-level umbilical cord blood lead levels can also negatively impact responses to acute stress (Gump et al., 2008).

Other research has found that young children with pre-natal lead exposure have lower scores on verbal IQ components (Wasserman et al., 2000), impairment in hearing and motor development (Rothenberg et al., 1994), and increases in learning disabilities and attention deficit disorders (Ris et al., 2004).

Prenatal Assessment and Intervention

The CDC does not recommend blood lead testing of all pregnant women in the United States. Instead, the CDC recommends that state or local health departments identify populations at increased risk for lead exposure (see Figure 11.1) and provide guidance about community-specific risk factors to assist clinicians in determining the need for blood lead testing for identified populations or for individuals at risk.

Figure 11.1. Risk Factors for Lead Exposure in Pregnant and Lactating Women

Recent immigration from or residency in areas where ambient lead contamination is high
Example: Women from countries where leaded gasoline is still being used (or was recently phased out) or where industrial emissions are not well controlled.

Living near a point source of lead
Example: Lead mines, smelters, or battery recycling plants (even if the establishment is closed).

Working with lead or living with someone who does
Example: Women who work in or who have family members who work in lead industry (take-home exposures).

Using lead-glazed ceramic pottery
Example: Women who cook, store, or serve food in lead-glazed ceramic pottery made in a traditional process and usually imported by individuals outside the normal commercial channels.

Eating nonfood substances (pica)
Example: Women who eat or mouth nonfood items that may be contaminated with lead (such as soil or lead-glazed ceramic pottery).

Using alternative or complementary medicines, herbs, or therapies
Example: Women who use imported home remedies or certain traditional herbs that may be contaminated with lead.

Using imported cosmetics or certain food products
Example: Women who use imported cosmetics, such as kohl or surma, or certain imported foods or spices that may be contaminated with lead.

Engaging in certain high-risk hobbies or recreational activities
Example: Women who engage in high-risk activities or have family members who do.

Renovating or remodeling older homes without lead hazard controls in place
Example: Women who have been disturbing lead paint and/or creating lead dust or spending time in such a home environment.

Consumption of lead-contaminated drinking water
Example: Women whose homes have leaded pipes or source lines with lead.

Having a history of previous lead exposure or evidence of elevated body burden of lead
Example: Women who may have high body burdens of lead from past exposures, particularly those who are deficient in certain key nutrients (calcium, iron).

Living with someone identified with an elevated lead level
Example: Women who may have exposures in common with a child, close friend, or other relative living in the same environment.

Key Recommendations to Prevent or Reduce Lead Exposure

The CDC guidelines include general advice for pregnant women to avoid lead exposure (see Figure 11.2). Additional advice may be warranted due to specific local risk factors.

Figure 11.2. Key Recommendations to Prevent or Reduce Lead Exposure in Pregnant and Lactating Women

Never eat or mouth nonfood items, such as clay, soil, pottery, or paint chips, because they may be contaminated with lead.

Avoid jobs or hobbies that may involve lead exposure. If a household member works with lead, take precautions so they do not bring lead dust home. Such work includes construction or home renovation/repair in pre-1978 homes, and lead battery manufacturing or recycling.

Avoid using imported lead-glazed ceramic pottery produced in cottage industries and pewter or brass containers or utensils to cook, serve, or store food.

Avoid using leaded crystal to serve or store beverages.

Do not use dishes that are chipped or cracked.

Stay away from repair, repainting, renovation, and remodeling work being done in homes built before 1978 in order to avoid possible exposure to lead-contaminated dust from old lead-based paint. Avoid exposure to deteriorated lead-based paint in older homes.

Avoid alternative cosmetics, food additives, and medicines imported from overseas that may contain lead, such as azarcon, kohl, kajal, surma, and others.

Use caution when consuming candies, spices, and other foods that have been brought into the country by travelers from abroad, especially if they appear to be noncommercial products of unknown safety.

Eat a balanced diet with adequate intakes of iron and calcium.

Blood Lead Testing in Pregnancy and Early Infancy

Health care providers should consider the possibility of lead exposure in individual pregnant women by evaluating risk factors for exposure as part of a comprehensive occupational, environmental, and lifestyle health risk assessment of the pregnant woman. Blood lead testing should be performed if a risk factor is identified at any point during pregnancy.

When indicated, blood lead testing should take place at the earliest contact with the patient, ideally pre-conceptually or at the first prenatal visit, and be conducted using venous blood samples. Both maternal and infant blood lead test results, along with relevant environmental findings, should be incorporated into both the mother's and infant's medical records.

Follow-up Blood Lead Testing for Pregnant and Lactating Women and Infants

Follow-up blood lead testing is recommended for pregnant women with BLLs of 5 mcg/dL or greater and their newborn infants (see Tables 11.1, 11.2 and 11.3) to inform environmental and clinical decision-making. Pregnant women with confirmed BLLs of 45 mcg/dL and greater should be considered high-risk pregnancies and managed in consultation with experts in lead poisoning and high-risk pregnancy.

Table 11.1. Frequency of Maternal Blood Lead Follow-up Testing During Pregnancy

Venous[a] Blood Lead Level (BLL)	Follow-up Testing Schedule[b]
< 5	No follow-up is needed.
5 – 14	Within one month. Obtain a maternal BLL[c] or cord BLL at delivery.
15 – 24	Within one month and every two to three months. Obtain a maternal BLL[c] or cord BLL at delivery. More frequent testing may be indicated based on risk factor history.
25 – 44	Within one to four weeks and then every month. Obtain a maternal BLL[c] or cord BLL at delivery.
>= 45	Within 24 hours and then at frequent intervals depending on the clinical interventions and trend in BLLs. Consultation with a clinician experienced in the management of pregnant women with BLLs in this range is strongly advised. Obtain a maternal BLL[c] or cord BLL at delivery.

[a] Venous blood lead sample is recommended for maternal blood lead testing.

[b] The higher the BLL on the screening test, the more urgent the need for confirmatory testing.

[c] If possible, obtain a maternal BLL prior to delivery since BLLs tend to rise over the course of pregnancy.

Table 11.2. Schedule for Follow-up Blood Lead Testing in Neonates (< 1 Month of Age)

Initial Venous Blood Lead Level (BLL)[a]	Follow-up Test(s)[b]
< 5	According to local screening guidelines for children
5 – 24	Within one month (at first newborn visit)[c]
25 – 44	Within two weeks, consultation with clinician experienced in the management of children with BLLs in this range[d]
>= 45	Within 24 hours and then at frequent intervals depending on BLLs, consultation with experienced clinician[d]

[a]The initial blood lead level may be either from an umbilical cord sample at the time of delivery or an infant venous BLL. A venous blood sample is preferred over a capillary sample. Decisions to initiate or stop breastfeeding or initiate chelation therapy should be based on a venous blood lead test result only.

[b]If infants are breastfeeding, also follow recommendations for lactating women.

[c]According to pediatric health supervision guidelines (well-baby visit schedule) or as clinically indicated based on trends in BLLs.

[d]The higher the BLL on the initial test, the more urgent the need for confirmatory testing.

Table 11.3. Schedule for Follow-up Blood Lead Testing in Infants < 6 Months of Age

Venous Blood Lead Level (BLL)	Follow-up Testing[a, b]	Later follow up (after the BLL begins to decline)
< 10*	According to local lead testing guidelines for children	According to the local lead screening guidelines for children
10 – 14	three months[c]	Within six to nine months
15 – 19	one to three months[c]	Within three to six months
20 – 44	one to three months[d]	Within one month
>= 45	Within 24 hours[d]	As directed by clinician managing chelation treatment

[a]After six months of age, follow recommendations found in *Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention,* Report of the Advisory Committee on Childhood Lead Poisoning Prevention of the Centers for Disease Control and Prevention, January 4, 2012
[b]If infants are breastfeeding, also follow the recommendations for lactating women.

[c] Some case managers or primary care providers may choose to repeat blood lead tests on all new patients within a month to ensure that their BLLs are not rising more quickly than anticipated. Seasonal variation of BLLs exists and may be more apparent in colder climate areas. Greater exposure in the summer months may necessitate more frequent follow-ups.

[d] Consultation with a clinician experienced in the management of children with BLLs in this range is strongly advised.

*These recommendations are based on the previous action level of 10 mcg/dL.

Recommended Actions for Pregnant and Lactating Women with Lead Exposure

Both the local health department and health care provider can play a role in keeping pregnant and lactating women and their offspring safe from lead exposure. Table 11.4 includes key recommendations from the CDC (2010) for the management of pregnant and lactating women by prenatal blood lead level.

Table 11.4. Recommended Actions by Blood Lead Level in Pregnancy

BLL	Health Care Providers	Public Health Providers
< 5	Provide anticipatory guidance and health education materials to all pregnant and lactating women.	• Collect all blood lead tests • Develop and disseminate guidelines and health education materials to clinicians • Provide community-specific risk factors and population-based blood lead testing guidance to clinicians
5 – 9	*Above actions plus* • Attempt to determine source(s) of lead exposure and counsel patients on strategies to reduce exposure • For occupationally exposed women, review proper use of personal protective equipment and consider contacting the employer • Assess nutritional adequacy • Confirmatory and follow-up testing (see Table 11.1)	*As above*

BLL	Health Care Providers	Public Health Providers
10–14	*Above actions plus* • Notify lead poisoning prevention program of local health department if not reported by the laboratory • Refer occupationally exposed women to occupational medicine specialists • For occupationally exposed women, recommend removal from exposure	*Above actions plus* • Send out health education materials to patient • For occupationally exposed women, remove from exposure
15–44[a]	*Above actions plus* • Assist local health departments with complete source exposure assessment	*Above action plus* • Perform or refer for environmental investigation, source reduction/lead hazard control, case management
≥45[b]	*Above actions plus* • Treat as high-risk pregnancy • Consider chelation (inpatient) in consultation with a lead poisoning expert	*Above action plus* • Facilitate consultation with a lead poisoning expert experienced in managing chelation in pregnant women

[a]Environmental interventions to control lead exposures at blood lead levels below those in this chart support the goal of lead-safe housing for all children and are appropriate in jurisdictions with resources available to provide such services.

[b]Blood lead levels ≥70 mcg/dL may result in significant maternal toxicity; therefore, chelation should be considered regardless of trimester of pregnancy and in consultation with an identified lead poisoning expert.

Breastfeeding and Lead Exposure

Human breast milk is specific to the needs of the infant and is the most complete and ideal source of infant nourishment in the first year of life. Decisions made with regard to breastfeeding by a mother whose blood lead levels exceed background levels should be based on scientific evidence suggesting undue risk for the child. Scientific observations have consistently shown that biologically significant elevations in milk lead concentration do not occur in lactating women at the blood lead concentrations typical of women with long-term residence in developed countries. Only a small number of American women will meet the criteria to defer breastfeeding, though more will be subject to additional follow up out of an abundance of caution.

The overall goal in counseling a woman whether or not to breastfeed is to provide the best possible nutritional and nurturing environment for the infant. Any decision either not to initiate or to discontinue breastfeeding must be made only after careful consideration of all the factors involved. The basis of the initial decision-making process should include a thorough discussion between the mother and her health care provider of the factors to be considered. This discussion should ideally take place before the baby is born. Many factors have an impact on whether or not a woman with a blood lead level ≥5 mcg/dL chooses to breastfeed her child. Thus, a detailed and balanced discussion is essential.

Lead in Breast Milk

The concentration of lead in breast milk is linked to the concentration of lead in the maternal blood. The total amount of lead in breast milk is stable over time and is determined by the mother's lifetime exposure and body burden of lead. The contribution of lead in breast milk to infant exposure to lead is usually less important than prenatal and other postnatal exposures. Infant blood lead levels primarily reflect maternal blood lead levels. Lead in breast milk contributes modestly to infants overall lead exposure, explaining 30 percent of the variance in infant blood lead levels at one month of age. The benefits of breastfeeding will most often outweigh concerns about infant exposure to lead from breast milk.

Several studies show breast milk lead to maternal blood lead ratios of approximately 3 percent or less (Gulson et al., 1998, Li et al., 2000, and Counter et al. 2004). Thus a maternal blood lead of 100 mcg/dL would be expected to be associated with a concentration of 3 mcg/dL lead in breast milk. Similarly, a blood lead of 10 mcg/dL would be expected to be associated with a breast milk lead concentration of 0.3 mcg/dL. A more recent study found blood lead and plasma lead have nonlinear relationships to breast milk lead (Ettinger et al., 2006).

The amount of any substance transferred from blood to breast milk is dependent on its solubility and binding affinities. Lead is an ionized metal, bound tightly to red blood cells, and is found at low levels in the plasma. These characteristics inhibit transfer of lead into breast milk.

The *half-life* of a chemical substance refers to the amount of time required for a quantity to fall to half its value as measured at the beginning of the time period. This idea is often used when evaluating the effect of a dose of a specific medication or a poisoning incident. The long half-life of lead in breast milk (13 weeks) is due to bone stores of lead that can be mobilized, move into the blood, and become available for transfer into breast milk.

Evidence suggests that the breast milk lead to maternal blood lead ratio may increase in a nonlinear fashion when maternal blood lead concentrations exceed about 40 mcg/dL. This hypothesis is supported both by observational data on women with very high breast milk lead concentrations (Li et al., 2000; Namihara et al., 1993) and by studies on the components of the blood (e.g., plasma) and breast milk as they relate to maternal lead exposure (Hernandez-Avila et al., 1998; Manton and Cook, 1984; Manton et al.. 2001; O'Flaherty, 1993; Schutz et al., 1996). A finding that breast milk contains proportionally more maternal lead at higher blood lead levels suggests possible risk associated with breastfeeding at maternal blood lead levels above 40 mcg/dL.

For lactating women with a history of past high lead exposure and low dietary calcium intake, a randomized trial showed that providing calcium supplements lowered blood lead levels in lactating women (Hernandez-Avila et al., 2003). For such women, calcium supplements could be expected to protect children by lowering the lead in breast milk.

Most recent studies measuring lead in breast milk of the general population have found the average level has been in the lower end of a range from 0.1 to 2 mcg/dL (100 cc) of breast milk (American Academy of Pediatrics, 2005, Ettinger et al., 2014). The decline in these averages is believed to correspond with the decline in BLLs of the general population.

At this time, there is no laboratory in Wisconsin that can do routine analysis of lead content in breast milk. For more information, health care providers can call the Wisconsin State Laboratory of Hygiene (608-224-6252).

Infant Dose of Lead from Breast Milk

Using the lower average amount of lead in breast milk (0.1 mcg/dL) and an average intake of breast milk of 700 cc (24 oz.), a daily dose of 0.7 mcg of lead/day can be estimated. This would be considered a low level of dietary lead intake, and a considerable drop from the U.S. Food and Drug Administration Total Diet Study estimate of infants' daily lead intake of approximately 5 mcg. The amount of lead in breast milk will be relatively stable during nursing.

Recommendations for Lactating Women with Lead Exposure

On the basis of the health and developmental benefits to infants of breastfeeding, and consideration of the available research on the contribution of breast milk lead to infant blood lead, CDC has developed clinical guidance for breastfeeding by women exposed to lead. Initial criteria for breastfeeding are maternal blood lead levels, but ongoing monitoring of infant blood lead levels provides the additional feedback loop needed for clinical decision making about continuing breastfeeding. Specifically, a rise in infant BLL of 5 mcg/dL or more is regarded as clinically significant and affects breastfeeding recommendations. Testing recommendations for women with BLL ≥5 mcg/dL identified during pregnancy or at delivery were presented previously in Table 11.1 and for infants in Tables 11.2 and 11.3. Measurement of breast milk lead is not recommended given current laboratory methods and the availability of maternal blood lead as a proxy.

Initiation of breastfeeding should be encouraged for all mothers with blood lead levels <40 mcg/dL, with follow-up recommendations varying by blood lead levels. Initial maternal BLLs <20 mcg/dL are unlikely to be associated with a detectable increase in infant blood lead, even using a ratio of breast milk to maternal blood 10 times the most likely value, as in the above calculations. In women with BLLs between 5-19 mcg/dL, an initial infant blood lead level is warranted to establish a baseline.

At maternal blood lead levels between 20-39 mcg/dL, data do not exist to weigh accurately the risks of lead exposure from breast milk against the benefits of breastfeeding. Thus, a prudent course of action is for these women to initiate breastfeeding accompanied by sequential mother and infant blood lead levels to monitor trends, so that adjustments can be made if indicated. Mothers with BLL between 20-39 mcg/dL should be retested two weeks postpartum and then at one to three-month intervals, depending on the direction and magnitude of trend in infant blood lead levels (Table 11.5).

CDC considered the adverse health and developmental effects associated with lead exposure compared to those associated with not breastfeeding and, based on the available information, determined that at maternal blood lead levels ≥40 mcg/dL the adverse developmental effects of an increase of ≥5 mcg/dL in an infant's blood lead level was of greater concern than the risks of not breastfeeding until maternal blood lead level dropped to <40 mcg/dL. Mothers with blood lead levels ≥40 mcg/dL should not initiate breastfeeding immediately. They should be advised to pump and discard their breast milk until their blood lead levels drop below 40 mcg/dL. In such cases, infants' blood lead levels should be monitored after the initiation of breastfeeding. This recommendation reaffirms the prevailing guidance about deferring breastfeeding at maternal BLL ≥40 mcg/dL.

For breastfed infants whose blood lead levels are rising or failing to decline by 5 mcg/dL or more, environmental and other sources of lead exposure should be evaluated. If no external source is identified, and maternal BLLs are >20 mcg/dL and infant BLL are ≥5 mcg/dL, then breast milk should be suspected as the source, and temporary interruption of breastfeeding until maternal blood lead levels decline should be considered. There are insufficient data to estimate how many mother-child pairs would meet these criteria, but anecdotal evidence suggests that it would apply to a very small number in the United States.

Table 11.5. Frequency of Maternal Blood Lead Follow-up Testing During Lactation[a] to Assess Risk for Infant Lead Exposure[b] from Maternal Breast Milk

Initial[c] Venous[d] Blood Lead Level	Perform Follow-up Blood Lead Test(s)
5 – 19	Every three months, per guidelines for adult blood testing, unless infant BLLs are rising or failing to decline[e]
20 – 39	Two weeks postpartum and then at one to three-month intervals depending on direction/magnitude of trend in infant BLLs
>= 40	Within 24 hours postpartum and then at frequent intervals depending on clinical interventions and trend in BLLs Consultation with a clinician experienced in the management of lead poisoning is advised.

[a]If a woman becomes pregnant while lactating, she should be followed according to the schedule for pregnancy.

[b]Need to coordinate care between mother and infant in postpartum period.

[c]Last blood lead level measured in pregnancy or at delivery (maternal or cord blood).

[d]Venous blood lead sample is recommended for maternal blood lead testing.

[e]Infant should be monitored according to schedule in Tables 11.2 and 11.3.

The content of this chapter is from the *Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women*, CDC, 2010.

References

American Academy of Pediatrics. “Breastfeeding and the Use of Human Milk.” *Pediatrics, 2005,* 111, pp. 496-506.

Borja-Aburto V. H., Hertz-Picciotti, I., Rojas Lopez, M., Farias, P., Rios, C., Blanco, J. “Blood Lead Levels Measured Prospectively and Risk of Spontaneous Abortion.” *American Journal of Epidemiology*, 1999 150(6), pp. 590-7.

Bressler, J. P., Goldstei, G. W. “Mechanisms of lead neurotoxicity.” *Bio Chem Phamacol*, 1991, 41(4), pp. 479-484.

Cory-Sletcha, D. A. “Relationship between Pb-induced changes in neurotransmitter system function and behavioral toxicity.” *Neurotoxicology*, 1997, 18(3), pp. 673-688.

Counter, S. A., Buchanan, L. H., Ortega, F. “Current Pediatric and Maternal Lead Levels in Blood and Breast Milk in Andean Inhabitants of a Lead Glazing Compound.” *J Occup Environ Med*, 2004, 46 (9), pp. 967-973.

Ettinger, A. S. and Wengrovitz, A. G., editors. “Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women,” Centers for Disease Control and Prevention*,* November 2010.

Ettinger, A. S., Roy, A., Amarasiriwardena, C. J., Smith, D., Lupoli, N., Mercado-Garcia, A., Lamadrid-Figueroa, H., Tellez-Rojo, M. M., Hu, H., Hernandez-Avila, M. “Maternal Blood, Plasma, and Breast Milk Lead: Lactational Transfer and Contribution to Infant Exposure.” *Environmental Health Perspectives,* 2014, 122 (1), pp 87-92.

Ettinger, A. S., Tellez-Rojo, M. M., Amarasiriwardena, C. J., Schwartz, J., Peterson, K. E., Aro, A. “Influence of Maternal Bone Lead Burden and Calcium Intake on Levels of Lead in Breast Milk Over the Course of Lactation.” *Am J Epidemiology*, 2006, 163, pp. 48-56.

Gonzalez-Cossio, T., Peterson, K. E., Sanin, L. H., Fishbein E., Palazuelos, E., Aror, A., et al. “Decrease in Birth Weight in Relation to Maternal Bone-Lead Burden.” *Pediatrics*, 1997, 100(5), pp. 856-962.

Goldstein, G. W. “Lead Poisoning and Brain Cell Function.” *Environmental Health Perspec*tives, 1990, 89, pp. 91-94.

Goldstein, G. W. Neurologic Concepts of Lead Poisoning in Children.” Pediatric Annals, 2002, pp. 384-388.

Gomaa, A., Hu, H., Bellinger, D., Schwartz J., Tsaih, S. W., Gonzalez-Cossio, T. et al. “Maternal Bone Lead as an Independent Risk Factor for Fetal Neurotoxicity: a Prospective Study.” *Pediatrics*, 2002, 100(1 Pt. 1), pp. 110-118.

Guerra-Tamayo, J. L., Hernandez-Cadena, L., Tellez-Rojo, M. M., Mercado-Garcia A. S., Solano-Gonzalez, M., Hernandez-Avila, M., et al. Time to Pregnancy and Lead Exposure. *Salud Publica Mex 45 Suppl*, 2003, 2, pp. 189-195.

Guilart, T. R., Miceli, R. C., Jett, D. A. “Neurochemical Aspects of Hippocampal and Cortical Pb2+ Neurotoxicity.” *Neurotoxicology*, 1994, 15(3), pp. 459-466.

Gulson, B. L., Jameson, C. W., Mahaffey, K. R., Mizon, K. J., Patison, N, Law, A. J., et al. “Relationships of Lead in Breast milk to Lead in Blood, Urine, Diet of the Infant and Mother.” *Environmental Health Perspectives*, 1998, 106(10), pp. 667-674.

Gump, B. B., Stewart, P., Reihman, J., Lonky, E., Darvill, T., Parsons, P. J., et all. “Low-Level Prenatal and Postnatal Blood Lead Exposure and Adrenocortical Responses to Acute Stress in Children.” *Environmental Health Perspectives*, 2008, 116(2), pp. 249-255.

Hernandez-Avila, M., Gonzalez-Cossio, T., Hernandez-Avila, J. E., Romieu, I., Peterson, K. E., Aro A, et al. “Dietary Calcium Supplements to Lower Blood Lead Levels in Lactating Women, a Randomized Placebo-Controlled Trial.” *Epidemiology*, 2003, 14, pp. 206-212.

Hernandez-Avila, M., Peterson K. E., Gonzalez-Cossio, T., Sanin, L. H., Aro, A, Schnaas, L., et la. “Effects of Maternal Bone Lead on Length and Head Circumference of Newborns and 1-Month Old Infants.” *Archives of Environmental Health*, 2002, 57(5), pp. 482-488.

Hernandez-Avila, M., Smith, D., Meneses, F. Sanin, L. H., Hu, H. “The Influence of Bone and Blood Lead on Plasma Lead Levels in Environmentally Exposed Adults.” *Environmental Health Perspectives*, 1998, 106(8), pp. 473-477.

Hu, H. “Knowledge of Diagnosis and Reproductive History Among Survivors of Childhood Plumbism.” *American Journal of Public Health,* 1991, 81, pp. 1070-1072.

Jackson, L. W., Correa-Villasenor, A., Lees, P. S., Dominici, F., Stewart, P. A., Breysse, P. N., et al. “Parental Lead Exposure and Total Anomalous Pulmonary venous return.” Birth Defects Res, 2004, 70-(4), pp. 185-193.

Jedrychowski, W., Perera, F., Jankowski, J., Rauh, V., Flak, E., Caldwell, K. L., et all. “Prenatal Low-Level Lead Exposure and Developmental Delays in Children at Age 6 Months.” *International Journal of Hygienic Environmental Health*, 2008, 211(3), pp. 345-351.

Jelliffe-Pawlowski, L. L. “Effect of Magnitude and Timing of Maternal Pregnancy Blood Lead (Pb) Levels on Birth Outcomes.” *Journal of Perinatology*, 2006 26(3), pp. 154-62.

Kennedy DA, Woodland C, Koren G. “Lead Exposure, Gestational Hypertension, and Pre-Eclampsia: A Systematic Review of Cause and Effect.” *Journal of Obstetrics and Gynaecology*, 2012, 32, pp. 512-517.

Lamadrid-Figueroa, H., Tellez-Rojo, M. M., Hernandez-Avila, M., Trejo-Valdiva, B., Solano-Gonzalez, M., Mercado-Garcia, A., et al. “Association between Plasma/Whole Blood Lead Ratio and History of Spontaneous Abortion: a Nested Cross-Sectional Study.” *BMC Pregnancy Childbirth*, 2007, 7, p. 22.

Li, P. J., Sheng, Y. Z., Wang, Q. Y., Gu L. Y. “Transfer of Lead Via Placenta and Breast Milk in Humans. *Biomedical Environmental Science*, 2000, 13(2), pp. 85-89.

Magri, J., Sammut, M., Savona-Vebntura, C. “Lead and Other Metals in Gestational Hypertension.” *Scandinavian Journal of Work and Environmental Health*, 2003, 83(1), pp. 29-36.

Manton, W. I., Cook, J. D. “High Accuracy (stable isotope dilution) Measurements of Lead in Serum and Cerebrospinal Fluid.” *British Journal of Industrial Medicine*, 1984, 41(3), pp. 313-319.

Manton, W. I., Rothenberg, S. J., Manalo, M. “The Lead Content of Blood Serum.” *Environmental Research*, 2001, 86(3), pp. 263-273.

Namihara, D., Saldivar, L., Pustilnik,N., Carreon, C. G., Salinas, M. E. “Lead in Human Blood and Milk from Nursing Women Living Near a Smelter in Mexico City.” *Journal of Toxicology and Environmental Health*, 38(3), pp. 225-233.

O’Flaherty, E. J. “Physiologically Based Models for Bone-Seeking Elements. IV. Kinetics of Lead Disposition in Humans.” Toxicology and Applied Pharmacology, 1993, 118(1), pp. 16-29.

Rabinowitz, M., Bellinger, D., Leviton, A., Needleman, H., Shoenbaum, S. “Pregnancy Hypertension, Blood Pressure During Labor and Blood Lead Levels.” *Hypertension,* 1987, 10(4), pp. 447-451.

Ris, M.D., Dietrich, K. N., Succop, P. A., Berger, O. G., Bornschein, R. L. ”Early Exposure to Lead and Neuropsychological Outcome in Adolescence.” *Journal of International Neuropsychology and Sociology*, 2004, 10(20), pp. 261-270.

Rodamilans M, Osaba MJ, To-Figueras J, Rivera Fillat F, Marques JM, Perez P, Corbella J. Lead toxicity on endocrine testicular function in an occupationally exposed population. Human Toxicology, 1988; 7(2), pp. 125-8.

Rothenberg, S. J., Manalo, M., Jiang, J., Cuellar, R. Reyes, S., Sanchez, M. et al. “Blood Lead Level and Blood Pressure During Pregnancy in South Central Los Angeles.” *Archives of Environmental Health*, 1999, 56(4), pp. 382-389.

Rothenberg, S. J., Poblano, A., Garza-Morales, S. “Prenatal and Perinatal Low Level Lead Exposure Alters Brain Stem Auditory Evoked Responses in Infants.” *Neurotoxicology*, 1994, 15(3), pp. 695-699.

Schnaas, L., Rothenberg, S. J., Flores, M. F., Matrinez, S., Hernanadez, C., Osorio, E., et al. “Reduced intellectual Development in Children with Prenatal Lead Exposure. *Environmental Health Perspectives*, 114(5) pp. 791-797.

Schultz, A., Bergdahl, I. A., Ekholm, A., Skerving, S. “Measurement by ICM-MS of Lead in Plasma and Whole Blood of Lead Workers and Controls.” Occupational and Environmental Medicine, 1996, 53(11), pp. 736-740.

Sowers, M. R., Scholl, T. O., Hall, G., Jannausch, Kemp, F. W., Li, X., et al. “Lead in Breast Milk and Maternal Bone Turnover.” American Journal of Obstetrics and Gynecology, 2002, 187(3), pp. 770-776.

Terrez-Rojo. M., Hernandez-Avila, M., Gonzalez-Cossio, T., Romieu, I., Aro, A., Palazuelos E, et al. “Impact of Breastfeeding on the Mobilization of Lead.” American Journal of Epidemiology, 155(5), pp. 420-428.

Torrez-Sanchez, I. E., Berkowitz, G., Lopez-Carrillo, L., Torres-Arreola, L., Rios, C., Lopez-Cervantes, M. “Intrauterine Lead Exposure and Preterm Birth.” *Environmental Research*, 1999, 81(4), pp. 297-301.

Vigeh, M., Yokoyama, K., Mazaheri, M., Beheshti, S., Ghazizadeh, S., Sakai, T., et al. “Relationship Between Increased Blood Lead and Pregnancy Hypertension in Women without Occupational Lead Exposure in Tehran, Iran.” *Archives of Environmental Health*, 2004, 59(2), pp. 70-75.

Wasserman, G. A., Liu, X., Popovac, D., Factor-Litvak, P., Kline, J., Waternaux, C, et al. “The Yugoslavia Prospective Lead Study: Contributions of prenatal and perinatal lead exposure to early intelligence.” *Neurotoxicology and Teratology*, 22(6), 2000, pp. 811-818.

West, W., Knight, E., Edwards, C., Manning, M., Spurlock, B., Hutchinson, J., Johnson, A., Oyemade, U., Cole, D., Westney, O., Laryea, H., Jones, S., and Westney, L. “Maternal Low Level Lead and Pregnancy Outcomes.” *American Institute of Nutrition*, 0022-3166, 9815-9865, 1994.

Wigg, N. R., Vimpani, G. V., McMchael, A. J., Baghurst, P. A., Robertson, E. F., Roberts, R. J. “Port Pirie Cohort Study: Childhood Blood Lead and Neuropsychological Development at Age Two Years.” *Journal of Epidemiology and Community Health*, 1988, 42, pp. 213-219.

Wu, T., Buck, G. M., Mendola, P. “Blood Lead Levels and Sexual Maturation in U.S. Girls: The Third National Health and Nutrition Examination Survey, 1998-1994.” *Environmental Health Perspectives*, 2003, 111(5), pp. 737-741.

Zhu M., Fitzgerald E. F., Gelberg, K. H., Lin S., Druschel C. M. “Maternal Low-Level Lead Exposure and Fetal Growth.” *Environmental Health Perspectives*, 2010, 118; 10, pp. 1471-1475.

Chapter 12

Reimbursement for Services to Children with Lead Poisoning Enrolled in the Wisconsin Medicaid Program

Contents

In Brief: Billing the Wisconsin Medicaid Program for Blood Lead Testing and Public Health Services to Children with Lead Poisoning 12.2

Introduction 12.4

Reimbursement for Blood Lead Testing 12.4

WIC Agencies may be Medicaid-Certified to be Reimbursed for Blood Lead Testing 12.5

Obtaining Prior Authorization 12.6

Submitting Claims 12.6

Medicaid Reimbursement for Environmental Investigations and Follow-up Inspections 12.7

Medicaid Reimbursement for Nursing Education Visits 12.7

Medicaid Reimbursement for Targeted Case Management 12.8

In Brief: Billing the Wisconsin Medicaid Program for Blood Lead Testing and Public Health Services to Children with Lead Poisoning

Activity	What is Billable	Steps in Billing
The following testing and analysis services can be billed when testing children for lead.		
Blood Lead Sample Collection	Interperiodic Visit (five minutes) CPT code 99211; modifier EP Capillary Blood Draw CPT code 36416 Lab Handling Fee CPT code 99000	Providers may be reimbursed for an office or other outpatient visit for the evaluation and management of an established patient, that may not require the presence of a physician or other qualified health care professional Providers may be reimbursed for collection of a capillary blood specimen using *Current Procedural Terminology* (CPT) code 36416 (Collection of capillary blood specimen [e.g., finger, heel, ear stick]) Providers may be reimbursed for CPT code 99000 Lab Handling Fee when drawing a blood specimen to be mailed to the laboratory for analysis. This CPT code covers handling and/or conveyance of specimen for transfer from the office to a laboratory.
Blood Lead Sample Analysis	Lead Testing CPT 83655	The laboratory that analyzes the blood lead sample can be reimbursed for CPT Code 83655 (lead). Providers performing onsite blood lead testing using LeadCare II or similar CLIA-waived instruments can be reimbursed for lead sample collection (CPT code 83655). Providers will not be reimbursed for the lab handling fee (CPT code 99000) in this situation.
The following services can be billed when provided to children with a venous BLL $\geq$19 mcg/dL or two BLLs 15-19 mcg/dL drawn at least three months apart.		
Environmental Lead Investigation	Comprehensive environmental lead investigation by a certified risk assessor, not including laboratory analysis, of the property inhabited by a child with lead poisoning.	Complete the Prior Authorization Request Form (PA/RF), F-11018 and the Prior Authorization / Environmental Lead Inspection Form (F-11062) to obtain prior authorization (PA). Use procedure code T1029 with modifier EP. Prior authorization requests can be submitted by phone, fax or on paper. See PA forms and instructions in the Appendices.

Activity	What is Billable	Steps in Billing
The following services can be billed when provided to children with a venous BLL >20 mcg/dL or two BLLs 15-19 mcg/dL drawn at least three months apart		
Nursing Education Visit	A home visit by a registered nurse to the home of a child with lead poisoning. Must be done in conjunction with an environmental investigation. If the nurse is also the risk assessor, the dates of service for the environmental investigation and the education visit cannot be the same.	The nursing education visit is covered under the PA for the environmental investigation. Use procedure code T1002 with modifier EP per 15 minutes. Can bill up to four 15-minute increments.
Follow-up Inspection	One return visit to the investigated property for inspection of the work performed and to obtain clearance dust wipe samples. Must be done in conjunction with an environmental investigation and within 365 days of the initial inspection.	Use procedure code T1002 with modifier TS; use approved PA number from original environmental investigation request.
The following services can be billed when provided to children with a venous BLL >20 mcg/dL or two BLLs 15-19 mcg/dL drawn at least three months apart		
Targeted Case Management (TCM) LHD must be approved to provide TCM for Group B Target Populations: Families with Children at Risk of Physical, Mental, or Emotional Dysfunction (a subgroup is: Families with a child/children with special health care needs, including children with lead poisoning).	Coordination of service activities only; direct services are not billable. Can be billed in addition to above services.	The assessment, case plan, ongoing monitoring, and service coordination must be documented.

Introduction

The Wisconsin Medicaid Program provides reimbursement to certified HealthCheck providers for blood lead testing of children enrolled in Medicaid and follow-up services provided to children who are lead poisoned. Medicaid reimbursement is a resource for Medicaid-eligible children that should be pursued by a local health department. The state general purpose revenue (GPR) funding provided through the consolidated contract for lead poisoning prevention services should be the "payer of last resort." The process of billing for blood lead testing services depends on whether the child is enrolled in Medicaid as a Fee-for-Service (FFS) participant or in a Medicaid managed care organization (MCO). Billing for testing of FFS participants is submitted directly to Medicaid. Billing for testing of managed care participants must be done through a contract with the MCO.

The cost of lab analysis of the sample is billable by the analytical laboratory, either as FFS or to the appropriate MCO. Follow-up services provided to children with a venous BLL ≥ 19 mcg/dL or two consecutive BLLs of 15-19 mcg/dL drawn at least three months apart are billable as FFS for all Medicaid-enrolled children, including those in an MCO. These services include a nursing education visit, an initial environmental investigation conducted by a certified risk assessor, and a follow-up investigation for clearance and collection of dust wipe samples. The local health department must be a certified HealthCheck provider and the person doing the inspection must have received the DHS-approved lead inspection training and be certified to provide this service. In addition, Targeted Case Management may be billed for children with a venous BLL ≥20 mcg/dL or two venous BLLs of 15-19 mcg/dL drawn at least three months apart.

Detailed information regarding reimbursement, the prior authorization process, and requirements for environmental lead inspections and blood lead testing can be found in this chapter. This information can be found in the Wisconsin Medicaid Provider Online Handbook at ForwardHealth Provider Handbook. In the right-hand margin, select "BadgerCare Plus and Medicaid" as the program and "HealthCheck (EPSDT)" as the service area to locate resources related to lead poisoning services and billing procedures. Scroll down on the right-hand margin to select the desired section or chapter of the handbook for viewing. The Provider Services and Resources Reference Guide lists services and resources available to providers and members with contact information and hours of availability. (This reference guide is also located in Appendix A.)

Reimbursement for Blood Lead Testing

A blood lead test (venous or capillary) is a required component of a HealthCheck examination at certain ages. Providers may be reimbursed for collection of a capillary blood specimen (e.g., finger stick) using CPT (Current Procedural Terminology) code 36416 (Collection of capillary blood specimen [e.g., finger, heel, ear stick]). Providers may be reimbursed for CPT code 36416 and CPT code 99000 (Handling and/or conveyance of specimen for transfer from the physician's office to a laboratory) when drawing a finger stick blood specimen to be mailed to

the laboratory for analysis. The handling fee covers the collection, preparation, forwarding and handling of obtained specimens. For more information, refer to ForwardHealth Update No. 2008-191; November 2008, entitled "Coverage of Capillary Blood Draw."

A five-minute interperiodic visit (CPT code 99211; modifier EP) can be billed for an office or other outpatient visit for the evaluation and management of an established patient that may not require the presence of a physician or other qualified health care professional.

There is reimbursement for a "Lab Handling Fee" (CPT code 99000), which covers packaging and/or transporting the blood sample to the laboratory that will do the analysis.

A "Lab Analysis Fee" (CPT code 83655 Lead) is billable only by the laboratory doing the analysis of the blood. In most cases, blood samples submitted by LHDs are analyzed by the Wisconsin State Laboratory of Hygiene (WSLH). If the child is enrolled in Medicaid FFS, the child's Medicaid number should be entered on the laboratory submission form to facilitate the laboratory's ability to bill the Wisconsin Medicaid Program or the appropriate MCO for analysis.

When doing onsite lead testing, providers may be reimbursed for CPT code 36416 and CPT code 83655 (Lead). Providers will not be reimbursed for the lab handling fee CPT code 99000 in this situation because the blood sample is not being sent to an outside laboratory. Providers may be reimbursed for onsite blood lead testing if the following guidelines are met: 1) Providers must be successfully participating in the proficiency testing (PT) program as administered by the WSLH or another Centers for Medicaid and Medicaid Services-approved PT program; and 2) Providers must report all lead testing results, regardless of the lead level, to the Wisconsin Childhood Lead Poisoning Prevention Program. For more information, refer to BadgerCare+ Update, April 2008, No. 2008-27, entitled "Guidelines for Reimbursement for On-Site Blood Lead Testing."

For children enrolled in Medicaid Managed Care, the cost of drawing a blood lead sample, lab handling fee, and analysis is assumed by the managed care organization (MCO) under their contract with the State of Wisconsin for care of Medicaid children. If a contract exists between the local health department and the child's MCO to provide HealthCheck examinations or blood lead testing, the reimbursement rate for providing these services should be negotiated as part of the contract.

If a blood lead test for a child enrolled in a Medicaid MCO is submitted by the local health department to the WSLH for analysis, the child's Medicaid number and the name of the managed care organization should be included on the lab requisition form. This information will facilitate WSLH in billing the MCO for the analysis. If the MCO prefers the use of a laboratory other than the WSLH, it is up to the LHD to obtain the equipment and forms required by that laboratory.

WIC Agencies may be Medicaid-Certified to be Reimbursed for Blood Lead Testing

ForwardHealth is including WIC agencies for Medicaid certification because approximately 82 percent of all children seen in WIC clinics in Wisconsin are Medicaid and BadgerCare Plus members. The Centers for Medicare and Medicaid Services requires that all children on Medicaid and BadgerCare have their blood tested for lead levels at age 1 and again at age 2. Beginning December 1, 2010, WIC agencies that contracted with the Wisconsin Division of

Public Health were able to apply to become Medicaid certified. By being certified with Wisconsin Medicaid, WIC agencies may be reimbursed for blood lead testing services performed on children age 4 and younger who are enrolled in Medicaid. See ForwardHealth Update No. 2010-102, November 2010, entitled "WIC Agencies May Now Be Medicaid-Certified to Be Reimbursed for Blood Lead Testing Services" for complete information on applying for certification, establishing a provider portal account, claims submission, and documentation requirements.

Obtaining Prior Authorization

Prior authorization (PA) from Medicaid is required before billing for services provided to a lead-poisoned child, e.g., environmental lead inspection, nursing education visit and follow-up inspection. Once prior authorization is obtained, all three services can be billed under the same PA number. The PA can be backdated for four days and is in effect for 365 days after the authorized date. The PA number must be submitted on the claim forms. A confirmation by mail will be sent and should be kept as part of the permanent record.

The following steps are taken to obtain prior authorization:

- Complete the Prior Authorization Request Form (PA / RF) (F-11018) and the Prior Authorization for Environmental Lead Inspection (PA/EI) (F-11062). These forms and the Prior Authorization / Environmental Lead Inspection Instructions (F-11062A) are included in Appendix A of this document and are available in the online Medicaid provider handbook at "Prior Authorization: Services Requiring Prior Authorization – Environmental Assessments for Lead Poisoning." (See Appendix A for the Prior Authorization Request form, Prior Authorization / Environmental Lead Inspection (PA/ELI) form and PA/ELI Instructions.)
- STAT-PA: The ForwardHealth Specialized Transmission Approval Technology-Prior Authorization (STAT-PA) System is an automated voice response system that allows Medicaid-certified providers to receive prior authorization (PA) via telephone rather than by mail or the Web. Providers answer a series of questions and receive an immediate response that a PA has been approved or returned. See "STAT-PA System Instructions" (F-11055) in the online provider handbook or in Appendix A.
- A request for prior authorization can also be submitted by fax or paper. Complete instructions on submitting prior authorization requests is available in the online provider handbook at "Prior Authorization: Submission Options."

Submitting Claims

Claims for services provided to lead-poisoned MA-eligible children are submitted to Forward Health. The prior authorization number must be included on the claims. The Procedure codes for services associated with lead-poisoned children are:

T1002 (can bill up to four 15-minute visits)	RN Services up to 15 minutes
T1029	Dwelling Lead Investigation
T1029 w/modifier TS	Follow-up Environmental Inspection
T1017, each 15 minutes	Targeted Case Management

Claims for HealthCheck services can be submitted electronically or on paper up to 365 days from the date of service. Providers are encouraged to submit claims electronically. The Division of Health Care Access and Accountability offers electronic billing software at no cost to the

provider. The Provider Electronic Solutions (PES) software allows providers to submit electronic claims using the 837 transaction. Providers may obtain the PES software by downloading it from the ForwardHealth Portal. For assistance installing and using PES software, providers may call the EDI Helpdesk.

Complete information on claim submission for various types of HealthCheck services is available at Claims: Submission. Providers can contact the ForwardHealth Provider Services Call Center at 800-947-9627 with questions about billing. Call center correspondents are available Monday through Friday 7:00 a.m. – 6:00 p.m. (Central Time), with the exception of state-observed holidays.

Medicaid Reimbursement for Environmental Investigations and Follow-up Inspections

An environmental investigation of the home of a lead-poisoned child is reimbursable through MA if:

- ✓ the child's blood lead level is a venous BLL ≥ 19 mcg/dL or two BLLs of 15-19 mcg/dL drawn at least three months apart;
- ✓ a certified risk assessor or hazard investigator performs the service; and
- ✓ prior authorization is received. If the first test was a capillary of ≥20 mcg/dL, the request for prior authorization can be initiated while a venous sample is being obtained for confirmation.

The environmental investigation (risk assessment or hazard investigation) includes identifying lead hazards, ordering lead hazard reduction, and a follow-up investigation to assure that lead hazards were treated properly.

The follow-up investigation must also be performed by a certified risk assessor or hazard investigator and is billed separately from the initial investigation (see above for procedure codes). The follow-up investigation must occur within 365 days of the date of the prior authorization.

Medicaid Reimbursement for Nursing Education Visits

A maximum of 60 minutes (up to four 15-minute billable increments) can be reimbursed for the public health nurse home visit to provide education related to lead poisoning for children with one venous BLL ≥ 19 mcg/dL or two venous BLLs ≥15-19 mcg/dL drawn at least three months apart. Prior authorization for the education visit is included when the PA request is approved for the environmental lead inspection. An interperiodic visit may also be billed if the child is provided services by the LHD as a result of blood lead levels in this range. An example would be if the LHD provided further developmental or behavioral assessments or nutrition counseling because of the elevated blood lead result drawn during a HealthCheck examination.

If the certified risk assessor is also a public health nurse, the environmental investigation and nursing education visit must be provided on different dates to obtain Medicaid reimbursement for both services. The PA number for the environmental investigation must be submitted along with the request for reimbursement for the nursing education visit.

Medicaid Reimbursement for Targeted Case Management

The WCLPPP considers that the assessment and coordination of services provided to a lead-poisoned child are covered by the definition and assessment required for reimbursement for Medicaid Targeted Case Management (MTCM). A side-by-side comparison of Nursing Services to Lead-Poisoned Children and MTCM can be found in Figure 12.1 at the end of this chapter.

MTCM is a reimbursable service provided for children with a venous BLL ≥ 20 mcg/dL or two venous BLLs of 15-19 mcg/dL drawn at least three months apart. As defined by Wis. Admin. Code DHS 107.32(1)(a), case management services covered by MA are services provided "to help a recipient, and, when appropriate, the recipient's family gain access to, coordinate or monitor necessary medical, social, educational, vocational and other services."[1] While a case manager may be coordinating as well as providing services, no direct services are included in billable time for case management. In the case of lead-poisoned children, several of the direct services that are required (nursing education visit, environmental investigation and follow-up investigation) can be billed separately. Thus, a local health department can bill for these one-time services, as well as the time it takes to coordinate the complex needs of lead-poisoned children and their families.

MTCM includes the components of assessment, case plan development, and ongoing monitoring and service coordination. In addition, there are specific activities performed by case managers that are required by or covered under MTCM. These are described briefly below.

WCLPPP has worked with the Wisconsin Medicaid program to assure that the information collected on the WCLPPP reporting forms for EBL cases fulfills the documentation needs for MTCM. To provide complete documentation of MTCM for a lead-poisoned child, also complete the Medicaid Targeted Case Management Face Sheet – Childhood Lead Poisoning (F-44771AA, also in Appendix A). The face sheet does not have to be returned to WCLPPP.

Components of Medicaid Targeted Case Management

Assessment and Case Plans – An assessment and case plan must be completed prior to approval of reimbursement of ongoing monitoring and service coordination activities. The required components of the comprehensive assessment are precisely articulated in the Medicaid Provider Online Handbook. Any assessment tool can be used as long as all required components are addressed. WCLPPP has collaborated with WMAP to include components that must be documented for MTCM on the WCLPPP Nursing Case Management Report (F-44771A). An additional face sheet was developed (F-44771AA) that can be filled out by LHDs wishing to bill for MTCM to complete documentation of the required assessment. This face sheet should not be turned in to WCLPPP, but kept with the child's record for reference and auditing purposes. Both of these forms can be found in the Appendices.

Other assessment and case planning items to be aware of for MTCM include the following:

- MTCM covers the time of all individuals participating in the assessment and case planning who meet requirements stated in the handbook.
- If emergency case management is necessary, WMAP can be billed for MTCM for up to 30 days prior to completion of an assessment or case plan. The emergency nature of the case must be documented in the recipient's record.

[1] DHS 107.32(1)(a)1

- Two comprehensive case management assessments and the development of two case plans are allowed per calendar year, even when children have not changed county of residence. The child's record must indicate the rationale for a new comprehensive assessment. A new assessment and/or case plan may be required due to changing member or family needs, or because of a change of county residence. The record must indicate the rationale for a new assessment.

Ongoing Monitoring and Service Coordination – Ongoing evaluation consists of a regular review of the case plan and/or the recipient's status. Only a single designated case manager can do ongoing evaluation and service coordination, and receive reimbursement.

- Monitoring and service coordination include activities to mobilize support services, advocating for the child, educating about the child's needs, and evaluating and coordinating services specified in the plan.
- Every month, the case manager must have: (1) a face-to-face **or** telephone contact with the recipient/family/collateral, **or** (2) a written contact with a collateral. For lead-poisoned children, a collateral may be the child's parents/guardians, landlord, teachers/daycare providers, WIC or other nutritionists, or physician. It may also include any contractor providing lead hazard reduction work on the house, agencies to assist in financing the reduction activities, or social service agencies. The case manager must document the rationale if the meeting or contact is less frequent than this.
- Every three months the case manager must document the occurrence of at least one face-to-face meeting with the recipient/family or a collateral. The case manager must document the rationale if the face-to-face meetings are less frequent than this.
- Examples of ongoing evaluation and service coordination for children with lead poisoning include:
  - ✓ assuring access to venous follow-up blood lead testing;
  - ✓ monitoring blood lead test results;
  - ✓ communication with the primary health care provider;
  - ✓ monitoring adherence to chelation protocol;
  - ✓ evaluating progress and success of lead hazard reduction orders;
  - ✓ success and quality of referrals for nutrition and educational support services; and
  - ✓ meetings between lead poisoning prevention team members to discuss case.

Record Keeping – All time involved in documentation or record keeping necessary for case planning, coordination, and service monitoring are covered by MTCM. For lead-poisoned children, this includes:

- recording blood lead levels;
- updating case plans;
- communication with the child's physician;
- documentation of lead hazard reduction activities;
- entering notes about case activity;
- preparing and responding to correspondence with recipients and collaterals; and
- gathering data.

APPENDIX A: FORMS

Contents

WCLPPP Reporting Forms – Blood Lead Lab Reporting (from Chapter 5.9)..... A1.2
WCLPPP Reporting Forms – Nursing Case Management Report (from Chapter 6.6) A1.3
WCLPPP Reporting Forms – Nursing Case Closure Report (from Chapter 6.9)..... A1.4
WCLPPP Reporting Forms – Property Investigation Report (from Chapter 7.2)..... A1.5
WCLPPP Reporting Forms – Property Investigation Closure Report (from Chapter 7.2)..... A1.6
WCLPPP Reporting Forms – Medicaid Targeted Case Management Face Sheet – Childhood Lead Poisoning (from Chapter 12.8)..... A1.7
ForwardHealth Forms – Prior Authorization Request Form (PA/RF) (from Chapter 12.6)..... A2.8
ForwardHealth Forms – Prior Authorization / Environmental Lead Inspection (from Chapter 12.6) A2.9
ForwardHealth Forms – Prior Authorization / Environmental Lead Inspection Instructions (from Chapter 12.6)..... A2.10
ForwardHealth Forms – STAT-PA System Instructions (from Chapter 12.6) A2.12
ForwardHealth Forms – Provider Services and Resources (from Chapter 12.4) A2.14

WCLPPP Reporting Forms – Blood Lead Lab Reporting

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
F-00017 (04/2014)

STATE OF WISCONSIN
Bureau of Environmental & Occupational Health
Chapter DHS 181
608-266-5817

BLOOD LEAD LAB REPORTING

This form is authorized under sections 250.04(3) and 254.13, Wis. Stats. and Chapter DHS 181, Wis. Admin. Code. Health care providers and laboratories are required to report all blood lead test results and all other information shown on this form if they obtain or analyze blood to determine lead in blood. Failure to report all this information within the required time limits is subject to forfeiture of up to $1,000 per day of violation or a fine of up to $5,000. The Department of Health Services will keep personally identifiable information about the patient confidential and will use these data only for legally authorized purposes.

Patient's Name (Last, First, Middle Initial)	Medical Assistance Number (If Applicable)

Date of Birth (mm/dd/yyyy)	Gender	Ethnicity (Check Appropriate Box)
	☐ Male ☐ Female	☐ Hispanic ☐ Non-Hispanic ☐ Unknown

Race (Check Appropriate Box)
☐ Native American ☐ Asian/Pacific Islander ☐ Black ☐ White
☐ Unknown ☐ Other, specify: _____

Patient's Street Address	Apartment Number

City	County	State	Zip Code

Parent / Guardian (Last, First, Middle Initial) (If Patient is Under 18 Years of Age)

Telephone Number of Patient or Parent / Guardian (If Patient is Under 18 Years of Age)
Home: - - Work: - -

Patient's Employer Name (If Patient is 16 Years of Age or Older)	Occupation

Employer's Address (Street, City, State, Zip Code)

Name of Health Care Provider	Telephone Number
	- -

Address of Provider (Street, City, State, Zip Code)

Name of Physician (If Different than Health Care Provider)	Telephone Number
	- -

Address of Physician (Street, City, State, Zip Code)

Date Blood Collected (mm/dd/yyyy)	Blood Collection Type (Check One)
	☐ Venous ☐ Capillary

ADDITIONAL INFORMATION TO BE PROVIDED BY THE LABORATORY

Laboratory Name	Clinical Laboratory Improvement Amendment Number

Address (Street, City, State, Zip Code)	Telephone Number
	- -

Date of Analysis (mm/dd/yyyy)	**Result:** _____ **micrograms lead per 100 milliliters of blood**

Timetable for Reporting	
Blood Lead Result (micrograms/100 milliliters)	Report Within
45 or more	24 hours
10 – 44	48 hours
0 – less than 10	30 days

Return to:
WISCONSIN DEPARTMENT OF HEALTH SERVICES
Division of Public Health
CLPPP/ABLES, Rm 145
P. O. BOX 2659
Madison, WI 53701-2659
Fax No.: 608-267-0402

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
F-44771A (Rev 11/06)

STATE OF WISCONSIN
ss. 254.15, Wis. Stats
Phone (608) 266-5817
FAX (608) 267-0402

NURSING CASE MANAGEMENT REPORT

Case Management Of Children with Elevated Blood Lead Levels*

*Elevated Blood Lead Level (EBLL) = 1 venous Blood Lead Level (BLL) ≥20 mcg/dL **OR** 2 venous BLLs of ≥15 mcg/dL drawn at least 90 days apart.

Completion of this form is mandatory for agencies contracting with the Division of Public Health for program funding. Personal identifiable information collected on this form will be used to document a completed home visit, assess the developmental status and determine the services needed. Data will be used in the aggregate to assist research and project future service needs. Nursing case management should follow the Case Management Protocol in the Wisconsin Childhood Lead Poisoning Prevention Program Handbook.

CHILD INFORMATION

Name of Child Last	First	MI	Date of Birth (mm/dd/yy)

Current Street Address	Apt. No.	City	County	Zip Code

Race: ☐ American Indian or Alaskan Native ☐ Asian ☐ Black or African American ☐ Native Hawaiian or Pacific Islander ☐ Multi-racial ☐ White ☐ Other (specify):

Ethnicity: ☐ Hispanic ☐ Non-Hispanic | Gender: ☐ Male ☐ Female

Legal Guardian Name Last | First

DEVELOPMENTAL ASSESSMENT

Name of Case Manager	Telephone No. (include area code)
Date of Home Visit: (mm/dd/yy) (must be completed before form is submitted)	
Date of Developmental Screening Test: (mm/dd/yy)	
Results of Developmental Screening Test were:	☐ Within Normal Limits Delays noted in: ☐ Language ☐ Gross Motor Skills ☐ Fine Motor Skills ☐ Personal-Social ☐ Other (specify):
If 2 or more delays are identified, standard of practice followed was:	☐ Repeat test scheduled in 2-4 weeks **or** ☐ Referral for developmental services. Give name of provider:
The child or family is enrolled in the following programs:	☐ Head Start ☐ Birth to 3/Early Intervention ☐ Early Childhood ☐ Parenting ☐ 4-Year Kindergarten ☐ Children with Special Health Care Needs (Regional CSHCN Center) ☐ Other (describe):
The child or family has been referred to the following programs:	☐ Head Start ☐ Birth to 3/Early Intervention ☐ Early Childhood ☐ Parenting ☐ 4-Year Kindergarten ☐ Children with Special Health Care Needs (Regional CSHCN Center) ☐ Refuses referral ☐ Other (describe):

Comments:

Send completed form to: **DEPARTMENT OF HEALTH AND FAMILY SERVICES**
Division of Public Health
Childhood Lead Poisoning Prevention Program
P. O. Box 2659, Room 145
Madison, WI 53701-2659

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
F-44771B (Rev 11/06)

STATE OF WISCONSIN
ss. 254.15, Wis. Stats
Phone (608) 266-5817
FAX (608) 267-0402

NURSING CASE CLOSURE REPORT

Case Management Of Children with Elevated Blood Lead Levels*

*Elevated Blood Lead Level (EBLL) = 1 venous Blood Lead Level (BLL) ≥20 mcg/dL **OR** 2 venous BLLs of ≥15 mcg/dL drawn at least 90 days apart.

Completion of this form is mandatory for agencies contracting with the Division of Public Health for program funding. Data will be used in the aggregate to assist research and project future service needs. Nursing case management should follow the Case Management Protocol in the Wisconsin Childhood Lead Poisoning Prevention Program Handbook. The case manager should discuss provisions for appropriate long-term developmental follow-up with the primary health care provider and caregiver. Managing Elevated Blood Lead Levels Among Young Children, Centers for Disease Control & Prevention, 2002.

CHILD INFORMATION

Name of Child - Last	First	MI	Date of Birth (mm/dd/yy)

Current Street Address	Apt. No.	City	County	Zip Code

Indicate how it was determined that the child is in a lead safe environment:

- ☐ Lead hazard remediation work complete, property met final visual clearance investigation, and dust wipe samples met clearance standards
- ☐ Child moved to a new property identified as lead safe
- ☐ The source of lead poisoning was not lead-based paint and the child is no longer exposed

CASE CLOSURE

Date Case Closed (mm/dd/yy)	Name of Case Manager	Telephone No. (include area code)

Reason for Closure:

- ☐ Minimum Closure Criteria Met: 2 BLLs <15mcg/dL at least 6 months apart **and** the child is in a lead-safe environment
- ☐ Moved, referral forwarded (if known, indicate new address below in comments)
- ☐ Unable to locate
- ☐ Family refuses further intervention

FOLLOW-UP OF DEVELOPMENTAL SCREENING TEST

When the screening test indicates 2 or more delays, the standards of practice call for the test to be repeated in 2-4 weeks or a referral to a provider for a comprehensive developmental assessment. The results of these follow-up actions are:

- ☐ No follow-up needed; screening test within normal limits
- ☐ The results of a second screening test were normal
- ☐ The results of a second screening test or referral indicated delays in:
  - ☐ Language ☐ Gross Motor Skills ☐ Fine Motor Skills
  - ☐ Personal - Social ☐ Other (specify):
- ☐ Other (describe):

REFERRALS OR OTHER SERVICES

The child or family is enrolled in:

- ☐ Head Start ☐ Birth to 3/Early Intervention ☐ Early Childhood ☐ Parenting
- ☐ 4-Year Kindergarten ☐ Children with Special Health Care Needs (Regional CSHCN Center)
- ☐ Refused referral ☐ Other (describe):

Comments:

Send completed form to:

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
Childhood Lead Poisoning Prevention Program
P. O. Box 2659, Room 145
Madison, WI 53701-2659

WCLPPP Reporting Forms – Property Investigation Report

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
F-44771C (Rev. 11/06)

STATE OF WISCONSIN
ss. 254.15, 254.166. Wis. Stats.
Phone (608) 266-5817
FAX (608) 267-0402

PROPERTY INVESTIGATION REPORT

Case Management Of Children with Elevated Blood Lead Levels*

*Elevated Blood Lead Level (EBLL) = 1 venous Blood Lead Level (BLL) ≥20 mcg/dL **OR** 2 venous BLLs of ≥15 mcg/dL drawn at least 90 days apart.

Completion of this form is mandatory for agencies contracting with the Division of Public Health for program funding. Personal identifiable information collected on this form is used to describe the causes and conditions of lead poisoning and to monitor services provided. Data will be used in the aggregate to assist research and project future service needs.

CHILD INFORMATION

Name Last	First	MI	Date of birth (mm/dd/yy):

PROPERTY INFORMATION

Street Address	Apt. No.	City	County	Zip Code

Owner Name	Telephone No.

Owner Street Address	City	State	Zip Code

Year of Construction (Actual or Estimated):

Address is (check one): ☐ Residence when EBLL identified ☐ Current residence ☐ Supplemental Address ☐ Other (describe):

Type of residence (check one): ☐ Section 8 Housing ☐ Owner Occupied ☐ Private Rental ☐ Public Housing

Family received federally mandated "Protect Your Family from Lead in Your Home" pamphlet from landlord or previous owner when they first moved in or prior to purchase of home: ☐ Yes ☐ No

PROPERTY INVESTIGATION INFORMATION

Date Investigation Referred (mm/dd/yy)	Date of Investigation (mm/dd/yy)	Name of Certified Risk Assessor/Hazard Investigator:

Main Cause(s) of Lead Based Paint Hazard(s) or Exposure (check all that apply)

- ☐ Deterioration
- ☐ Remodeling
- ☐ Repainting/scraping/ sanding
- ☐ Repair
- ☐ Mouthing/chewing surfaces
- ☐ Eating non-food items
- ☐ No Hazards present - property investigation closed
- ☐ Other (describe):

Location of Potential Hazard(s) (check all that apply)

Interior		Exterior	
☐ Windows	☐ Floors/stairs	☐ Windows	☐ Siding
☐ Doors	☐ Walls	☐ Doors	☐ Ceilings
☐ Trim	☐ Ceilings	☐ Soil	☐ Porches
☐ Other:		☐ Other:	

Method of Collection for Environmental Samples

Interior		Exterior	
☐ XRF	☐ Paint chip	☐ XRF	☐ Paint chip
☐ Dust wipe		☐ Dust wipe	☐ Soil

Dates For Lead Hazard Reduction Completion (mm/dd/yy)

Interior	Exterior
Interim controls	Interim controls
Abatement	Abatement

Date Property Investigation Report Sent to: Owner: Tenant:

Local health department has notified the owner and posted a notice that the property is untenantable, Wis. Stats. 704.07(4) and unsafe, dilapidated or unsanitary and therefore a human health hazard, Wis. Stats 254.59(3), or a presence of lead hazards Wis. Stats. 254.166 (2) ☐ Yes ☐ No

Other Lead Hazards or Sources Identified Based on Testing (check all that apply and describe): ☐ Folk remedies

☐ Mini-blinds ☐ Hobby ☐ Work related ☐ Pottery ☐ Water ☐ Other:

Description:

Send completed form to: **DEPARTMENT OF HEALTH SERVICES**
Division of Public Health
Childhood Lead Poisoning Prevention Program
P. O. Box 2659 , Room 145
Madison, WI 53701-2659

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
F-44771D (Rev. 11/06)

STATE OF WISCONSIN
ss. 254.15, 254.166, Wis. Stats.
Phone (608) 266-5817
FAX (608) 267-0402

PROPERTY INVESTIGATION CLOSURE REPORT

Case Management Of Children with Elevated Blood Lead Levels*

*Elevated Blood Lead Level (EBLL) = 1 venous Blood Lead Level (BLL) ≥20 mcg/dL **OR** 2 venous BLLs of ≥15 mcg/dL drawn at least 90 days apart.

Completion of this form is mandatory for agencies contracting with the Division of Public Health for program funding. Personal identifiable information collected on this form is used to describe the causes and conditions of lead poisoning and to monitor services provided. Data will be used in the aggregate to assist research and project future service needs.

CHILD INFORMATION

Name of Child - Last	First	MI	Date of birth (mm/dd/yy)

PROPERTY INFORMATION

Street Address	Apt. No.	City	County	Zip Code

Name of Certified Risk Assessor/Hazard Investigator who conducted clearance:

Completion dates of lead hazard reduction work (mm/dd/yy):

☐ Interior interim controls:

☐ Interior abatement:

☐ Exterior interim controls:

☐ Exterior abatement:

Date Property Investigation Closed: (mm/dd/yy)

Reason Investigation Closed:

☐ Property passed final visual clearance investigation and dust wipe samples met clearance standards and local health department provided results to the owner and occupants.

☐ Property with only exterior lead-based paint hazards passed final visual clearance investigation

☐ Other identified lead hazards removed. Specify:

If lead hazard reduction work not completed, describe further action taken:

☐ Referred to local legal authorities

☐ Local health department has notified the owner and posted a notice that the property is un-tenantable, Wis. Stats. 704.07 (4), and unsafe, dilapidated or unsanitary and therefore a human health hazard, Wis. Stats. 254.59 (3), or a presence of lead hazards Wis. Stats. 254.166 (2)

☐ Other action described:

Comments:

Send completed form with clearance dust wipe results to: **DEPARTMENT OF HEALTH SERVICES**
Division of Public Health
Childhood Lead Poisoning Prevention Program
P. O. Box 2659 , Room 145
Madison, WI 53701-2659

DEPARTMENT OF HEALTH SERVICES
Division of Public Health
F-44771AA (10/2014)

STATE OF WISCONSIN
Bureau of Environmental Health
Wis. Stat. § 254.15
(608) 266-5817
FAX: (608) 267-0402

MEDICAID TARGETED CASE MANAGEMENT FACE SHEET – CHILDHOOD LEAD POISONING

This form should be completed when Medicaid Targeted Case Management will be provided to an eligible child. The face sheet provides documentation of additional assessments required for reimbursement for targeted case management that is not included on the Case Report on Children with Elevated Blood Lead Levels.

THIS PAGE DOES NOT NEED TO BE RETURNED TO THE WISCONSIN CHILDHOOD LEAD POISON PREVENTION PROGRAM

CHILD INFORMATION

Name of child receiving targeted case management	Date of birth (mm/dd/yy)
Medicaid Number	

OTHER PROVIDERS INVOLVED IN ASSESSMENT OF THE CHILD

Name and Title	Role in the assessment
Name and Title	Role in the assessment
Name and Title	Role in the assessment

OTHER HOUSEHOLD MEMBERS RECEIVING CASE MANAGEMENT

Name of client	Name of Case Manager
Name of client	Name of Case Manager
Name of client	Name of Case Manager

ENVIRONMENTAL ASSESSMENT

Date of lead hazard investigation (mm/dd/yy)	Lead hazard investigation report on file ☐ Yes

Identify any other safety / health issues in the home that are to be addressed:

FAMILY RESOURCES

Dental care
How many times per year does this child see the dentist?

Date of the last dental visit (mm/dd/yy)

Financial
The family reports not having enough money for:

☐ Food ☐ Shelter ☐ Clothing ☐ Medical needs

Assistance provided to the family to address family financial resources:

Community
The family would like more information on the following topics: ☐ Recreation ☐ Employment and training ☐ Health care
☐ Child development ☐ Parenting skills ☐ Coping with stress ☐ Family resource center ☐ Other

SIGNATURE - Medicaid Targeted Case Manager	Date Signed (mm/dd/yy)

DEPARTMENT OF HEALTH SERVICES
ForwardHealth
F-11018 (05/13)

STATE OF WISCONSIN
DHS 106.03(4), Wis. Admin. Code
DHS 152.06(3)(h), 153.06(3)(g), 154.06(3)(g), Wis. Admin. Code

FORWARDHEALTH
PRIOR AUTHORIZATION REQUEST FORM (PA/RF)

Providers may submit prior authorization (PA) requests by fax to ForwardHealth at (608) 221-8616 or by mail to: ForwardHealth, Prior Authorization, Suite 88, 313 Blettner Boulevard, Madison, WI 53784. **Instructions:** Type or print clearly. Before completing this form, read the service-specific Prior Authorization Request Form (PA/RF) Completion Instructions.

SECTION I — PROVIDER INFORMATION

1. Check only if applicable ☐ HealthCheck "Other Services" ☐ Wisconsin Chronic Disease Program (WCDP)	2. Process Type	3. Telephone Number — Billing Provider
4. Name and Address — Billing Provider (Street, City, State, ZIP+4 Code)		5a. Billing Provider Number 5b. Billing Provider Taxonomy Code
6a. Name — Prescribing / Referring / Ordering Provider		6b. National Provider Identifier — Prescribing / Referring / Ordering Provider

SECTION II — MEMBER INFORMATION

7. Member Identification Number	8. Date of Birth — Member	9. Address — Member (Street, City, State, ZIP Code)
10. Name — Member (Last, First, Middle Initial)	11. Gender — Member ☐ Male ☐ Female	

SECTION III — DIAGNOSIS / TREATMENT INFORMATION

12. Diagnosis — Primary Code and Description	13. Start Date — SOI	14. First Date of Treatment — SOI
15. Diagnosis — Secondary Code and Description	16. Requested PA Start Date	

17. Rendering Provider Number	18. Rendering Provider Taxonomy Code	19. Service Code	20. Modifiers 1	2	3	4	21. POS	22. Description of Service	23. QR	24. Charge

An approved authorization does not guarantee payment. Reimbursement is contingent upon enrollment of the member and provider at the time the service is provided and the completeness of the claim information. Payment will not be made for services initiated prior to approval or after the authorization expiration date. Reimbursement will be in accordance with ForwardHealth payment methodology and policy. If the member is enrolled in a BadgerCare Plus Managed Care Program at the time a prior authorized service is provided, ForwardHealth reimbursement will be allowed only if the service is not covered by the Managed Care Program.

25. Total Charges	

26. **SIGNATURE** — Requesting Provider	27. Date Signed

DT-PA049-049

DEPARTMENT OF HEALTH SERVICES
Division of Health Care Access and Accountability
F-11062 (10/08)

STATE OF WISCONSIN
HFS 107.06(2), Wis. Admin. Code

FORWARDHEALTH

PRIOR AUTHORIZATION / ENVIRONMENTAL LEAD INSPECTION

Instructions: Type or print clearly. Before completing this form, read the Prior Authorization / Environmental Lead Inspection Instructions, F-11062A. Refer to the STAT-PA System Instructions, F-11055, for details regarding data entry through the Specialized Transmission Approval Technology-Prior Authorization (STAT-PA) system.

Providers may call ForwardHealth at (800) 947-9627 with questions.

SECTION I — MEMBER INFORMATION	
1. Name — Member	2. Date of Birth — Member
3. Member Identification Number	

SECTION II — PROVIDER INFORMATION	
4. Provider Name	5. National Provider Identifier

SECTION III — CLINICAL INFORMATION FOR ENVIRONMENTAL LEAD INSPECTION	
6. Member's Blood Lead Level	7. Date of Testing
8. Was a previous lead level test taken by the same member at least 90 days prior to the most recent test with a blood level greater than 15?	☐ Yes ☐ No
9. Has inspection staff completed the Department of Health Services-approved lead inspection training?	☐ Yes ☐ No

SECTION IV — FOR PROVIDERS USING STAT-PA	
10. Procedure Code	11. Diagnosis Code
12. Place of Service	13. Date of Service
14. Total Number of Services Requested	15. Assigned Prior Authorization Number
16. Grant Date	17. Expiration Date

NOTE:
An approved prior authorization (PA) request allows ForwardHealth's reimbursement for two services. This includes initial inspection (T1029, EP — Comprehensive environmental lead investigation, not including laboratory analysis, per dwelling; service provided as part of ForwardHealth's Early and Periodic Screening, Diagnosis, and Treatment [EPSDT] Program) and one follow-up inspection (T1029, EP and TS — Comprehensive environmental lead investigation, not including laboratory analysis, per dwelling; service provided as part of follow-up to ForwardHealth's Early and Periodic Screening, Diagnosis and Treatment [EPSDT] Program **and** follow-up service). Where necessary, one interperiodic visit for education related to lead poisoning may be provided after lead inspection PA has been approved. The code for this is T1002, EP (Registered nurse services, up to 15 minutes; service provided as part of ForwardHealth's Early and Periodic Screening, Diagnosis and Treatment [EPSDT] Program).

SECTION V — SIGNATURE	
18. **SIGNATURE** — Provider	19. Date Signed

DT-PA017-017

DEPARTMENT OF HEALTH SERVICES
Division of Health Care Access and Accountability
F-11062A (07/12)

STATE OF WISCONSIN
DHS 107.06(2), Wis. Admin. Code

FORWARDHEALTH
PRIOR AUTHORIZATION / ENVIRONMENTAL LEAD INSPECTION INSTRUCTIONS

ForwardHealth requires certain information to enable the programs to authorize and pay for medical services provided to eligible members.

Members of ForwardHealth are required to give providers full, correct, and truthful information for the submission of correct and complete claims for reimbursement. This information should include, but is not limited to, information concerning enrollment status, accurate name, address, and member number (DHS 104.02[4], Wis. Admin. Code).

Under s. 49.45(4), Wis. Stats., personally identifiable information about program applicants and members is confidential and is used for purposes directly related to ForwardHealth administration such as determining eligibility of the applicant, processing prior authorization (PA) requests, or processing provider claims for reimbursement. Failure to supply the information requested by the form may result in denial of PA or payment for the service.

The use of this form is mandatory when requesting PA for certain services. If necessary, attach additional pages if more space is needed. Refer to the applicable service-specific publications for service restrictions and additional documentation requirements. Provide enough information for ForwardHealth to make a determination about the request.

Providers may submit Prior Authorization/Environmental Lead Inspection requests in one of the following ways:

1) For Specialized Transmission Approval Technology-Prior Authorization (STAT-PA) requests, providers should call (800) 947-1197.

2) For paper PA requests by fax, providers should submit a Prior Authorization Request Form (PA/RF), F-11018, and the Prior Authorization/Environmental Lead Inspection form, F-11062, by fax to ForwardHealth at (608) 221-8616.

3) For paper PA requests by mail, providers should submit a PA/RF and the PA/Environmental Lead Inspection form to the following address:

   ForwardHealth
   Prior Authorization
   Ste 88
   313 Blettner Blvd
   Madison WI 53784

Providers should make duplicate copies of all paper documents sent to ForwardHealth. The provision of services that are greater than or significantly different from those authorized may result in nonpayment of the billing claim(s).

Environmental Lead Inspection Information and Requirements (Technical Aspects of Inspections)

1. Determine the most likely sources of high-dose exposure to lead.
2. Investigate the child's home, giving special attention to painted surfaces, dust, soil, and water.
3. Advise parents about identified and potential sources of lead and ways to reduce exposure.
4. Notify the property owner immediately that a child residing on the property has lead poisoning.
5. Monitor the effectiveness and timeliness of abatement procedures closely.
6. Coordinate environmental activities with those of other public health and social management agencies.

SECTION I — MEMBER INFORMATION

Element 1 — Name — Member
Enter the member's last name, first name, and middle initial. Use Wisconsin's Enrollment Verification System (EVS) to obtain the correct spelling of the member's name. If the name or spelling of the name on the ForwardHealth identification card and the EVS do not match, use the spelling from the EVS.

Element 2 — Date of Birth — Member
Enter the member's date of birth in MM/DD/CCYY format.

Element 3 — Member Identification Number
Enter the member ID. Do not enter any other numbers or letters.

SECTION II — PROVIDER INFORMATION

Element 4 — Provider Name
Enter the name of the provider who would perform/provide the requested service/procedure.

Element 5 — National Provider Identifier
Enter the National Provider Identifier of the provider performing the service.

SECTION III — CLINICAL INFORMATION FOR ENVIRONMENTAL LEAD INSPECTION

Element 6 — Member's Blood Lead Level
Enter the member's two-digit blood lead level. (If the blood level is a one-digit number, please precede the number with a zero when entering.)

Element 7 — Date of Testing
Enter the date of testing in MM/DD/CCYY format.

Element 8
Check the appropriate box to indicate whether or not the previous lead level test taken by the same member at least 90 days prior to the most recent test had a blood lead level greater than 15.

Element 9
Check the appropriate box to indicate whether or not the inspection staff has completed the Department of Health Services-approved lead inspection training.

SECTION IV — FOR PROVIDERS USING STAT-PA

Element 10 — Procedure Code
Enter procedure code "T1029" (Comprehensive environmental lead investigation, not including laboratory analysis, per dwelling).

Element 11 — Diagnosis Code
Enter the *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis code "984" (Toxic effect of lead and its compounds [including fumes]).

Element 12 — Place of Service
Enter the only allowable place of service code for environmental lead inspection ("12," the child's home).

Element 13 — Date of Service
The date of service may be up to 31 days in the future or up to 14 days in the past. Enter in MM/DD/CCYY format.

Element 14 — Total Number of Services Requested
Enter "1."

Element 15 — Assigned Prior Authorization Number
Record the PA number assigned by the STAT-PA system.

Element 16 — Grant Date
Record the grant date of the PA as assigned by the STAT-PA system.

Element 17 — Expiration Date
Record the date that the PA expires as assigned by the STAT-PA system.

SECTION V — SIGNATURE

Element 18 — SIGNATURE — Provider
The provider must sign this Element.

Element 19 — Date Signed
Enter the date signed in MM/DD/CCYY format.

DEPARTMENT OF HEALTH SERVICES **STATE OF WISCONSIN**
Division of Health Care Access and Accountability
F-11055 (10/11)

FORWARDHEALTH
STAT-PA SYSTEM INSTRUCTIONS

The ForwardHealth Specialized Transmission Approval Technology-Prior Authorization (STAT-PA) system is an automated voice response system that allows Medicaid-certified providers to receive prior authorization (PA) via telephone rather than by mail or the Web. Providers answer a series of questions and receive an immediate response of an approved or returned PA.

Providers communicate with the STAT-PA system by entering requested information on a touch-tone telephone keypad or by calling Provider Services. Providers must have their provider number to access the STAT-PA system.

The STAT-PA system is available by calling one of the following telephone numbers:

- **Touch-Tone Telephone**
  (800) 947-1197
  Available 24 hours a day, seven days a week.
- **Provider Services**
  (800) 947-9627
  Available from 7:00 a.m. to 6:00 p.m., Monday through Friday, excluding state-observed holidays.

REQUIRED INFORMATION

All providers using STAT-PA are required to provide the following information:

- Provider number.
- Practice Location ZIP+4 code.
- Member identification number.
- National Drug Code (NDC) or procedure code.
- *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) diagnosis code.
- Place of Service (POS) code.
- First date of service (DOS).
- Days supply or total number requested.

Note: When requesting a drug, prescribing provider information is required. Additionally, if a National Provider Identifier (NPI) is entered, and the requesting provider is not a retail pharmacy, the taxonomy code is required.

HOW TO USE WISCONSIN STAT-PA

1. Complete the appropriate PA attachment form.
2. Select mode of transmission (touch-tone telephone or Provider Services).

TOUCH-TONE TELEPHONE REQUESTS

To use a touch-tone telephone to submit a PA request:

1. Call (800) 947-1197. This connects the provider directly with the STAT-PA system.
2. When the system answers, it will ask a series of questions that providers answer by entering the information on the telephone keypad. The service-specific PA attachments list the information needed in the order it is requested by the STAT-PA system.

Note: When using a touch-tone telephone to enter the NPI, taxonomy code, member ID, NDC or procedure code, ICD-9-CM diagnosis code, POS code, requested first DOS, and quantity, always press the pound (#) key to mark the end of the data just entered. The pound (#) key signals the system that the provider has finished entering the data requested and ensures the quickest response from the system.

Providers may be asked to enter alphabetic data, which can be entered by using the asterisk (*) key. For example, a provider is asked to enter a procedure code such as L3216. The first character is an alpha character; therefore, the provider presses the single asterisk (*) key followed by the two digits that indicate the letter. The first digit is the number on the keypad where the letter is located, and the second digit is the position of the letter on that key. For example: Procedure code L3216 should be entered as *53 3 2 1 6.

Alphabet Key:

A = *21	G = *41	M = *61	S = *73	Y = *93
B = *22	H = *42	N = *62	T = *81	Z = *12
C = *23	I = *43	O = *63	U = *82	
D = *31	J = *51	P = *71	V = *83	
E = *32	K = *52	Q = *11	W = *91	
F = *33	L = *53	R = *72	X = *92	

3. Once all data have been entered completely, STAT-PA processes the information, indicates the status of the PA request, and gives providers the chance to finalize, cancel, or change their entered information. Once the PA request is finalized, STAT-PA indicates the PA number and, if approved, the effective dates and authorized number of services.

Once familiar with the STAT-PA system, providers may enter the PA information in the designated order immediately — there is no need to wait for the full voice prompt. Providers may key information at any time, even when the system is processing information. The system automatically proceeds to the next function.

PROVIDER SERVICES REQUESTS

Providers who do not have a touch-tone telephone may call Provider Services at (800) 947-9627. The Provider Services correspondent will access STAT-PA and enter the required data requested from the provider.

Provider Services is available to all STAT-PA users. Providers who are experiencing difficulties with the system can select to be transferred to Provider Services for assistance.

DOCUMENTATION INFORMATION

Providers must maintain all documentation that supports medical necessity, claim information, and delivery of the approved service(s) in their records for a period not less than five years. Regardless of what STAT-PA method is used, providers will receive a letter by mail indicating the assigned PA number and the STAT-PA decision. Providers with a secure ForwardHealth Portal account will also receive a copy of this letter in their portal mailbox. This letter should be maintained as a permanent record of the transaction.

Helpful Hints

- The provider is given three attempts at each field to correctly enter the requested data. If those attempts are unsuccessful, the provider can select to be transferred to Provider Services for assistance, or the call will be terminated.
- Providers are given two attempts to enter data within 10 seconds. If those attempts are unsuccessful, the provider can select to be transferred to Provider Services for assistance, or the call will be terminated.
- Providers are allowed 25 PA requests per connection for touch-tone telephone.
- Providers are allowed up to 25 minutes per connection for touch-tone telephone.
- The decimal point for diagnosis codes is not required when entering a STAT-PA request by touch-tone telephone; however, all digits of the codes must be entered.
- The first date of service entered by the provider may be up to 31 calendar days in the future or up to 14 days in the past.
- Providers who need to end date a PA request due to a change in prescription may do so through STAT-PA if the request was originally submitted through STAT-PA. If a provider needs assistance with the end date process, the provider may select to be transferred to Provider Services for assistance.

Provider Services and Resources

Services and resources, contact information, and hours of availability are effective after ForwardHealth implementation, unless otherwise noted.

ForwardHealth Portal	***www.forwardhealth.wi.gov/***	**24 hours a day, seven days a week**
Public and secure access to ForwardHealth information with direct link to contact Provider Services for up-to-date access to ForwardHealth programs information, including publications, fee schedules, and forms.		
WiCall Automated Voice Response System	**(800) 947-3544**	**24 hours a day, seven days a week**
WiCall, the ForwardHealth Automated Voice Response system, provides responses to the following inquiries: • Checkwrite. • Claim status. • Prior authorization. • Member enrollment.		
ForwardHealth Provider Services Call Center	**(800) 947-9627**	**Monday through Friday, 7:00 a.m. to 6:00 p.m. (Central Time)***
To assist providers in the following programs: • BadgerCare Plus. • Medicaid. • SeniorCare. • Wisconsin Well Woman Medicaid. • Wisconsin Chronic Disease Program (WCDP). • Wisconsin Well Woman Program (WWWP). • Wisconsin Medicaid and BadgerCare Plus Managed Care Programs.		
ForwardHealth Portal Helpdesk	**(866) 908-1363**	**Monday through Friday, 8:30 a.m. to 4:30 p.m. (Central Time)***
To assist providers and trading partners with technical questions regarding Portal functions and capabilities, including Portal accounts, registrations, passwords, and submissions through the Portal.		
Electronic Data Interchange Helpdesk	**(866) 416-4979**	**Monday through Friday, 8:30 a.m. to 4:30 p.m. (Central Time)***
For providers, trading partners, billing services, and clearing houses with technical questions about the following: • Electronic transactions. • Companion documents. • Provider Electronic Solutions (PES) software.		
Managed Care Ombudsman Program	**(800) 760-0001**	**Monday through Friday, 7:00 a.m. to 6:00 p.m. (Central Time)***
To assist managed care enrollees with questions about enrollment, rights, responsibilities, and general managed care information.		
Member Services	**(800) 362-3002**	**Monday through Friday, 7:00 a.m. to 6:00 p.m. (Central Time)***
To assist ForwardHealth members or persons calling on behalf of members with program information and requirements, enrollment, finding certified providers, and resolving concerns.		

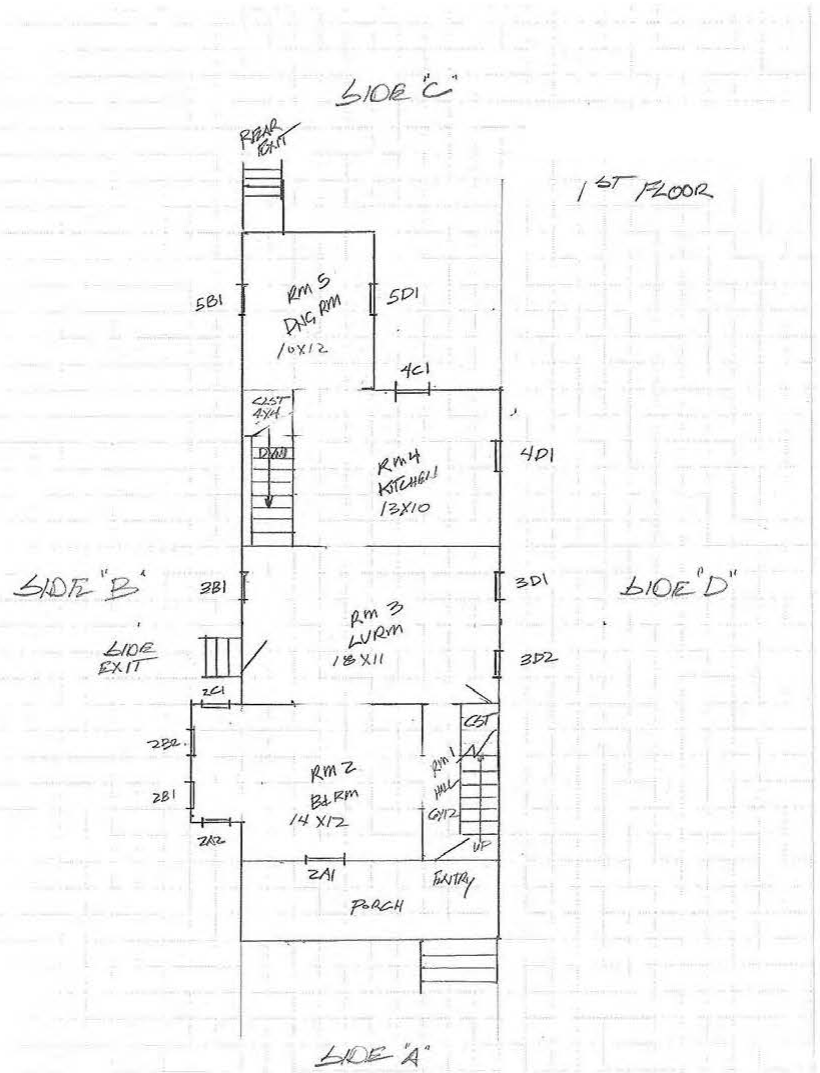
* With the exception of state-observed holidays.

APPENDIX B: SAMPLES (documents here accompany Chapter 7)

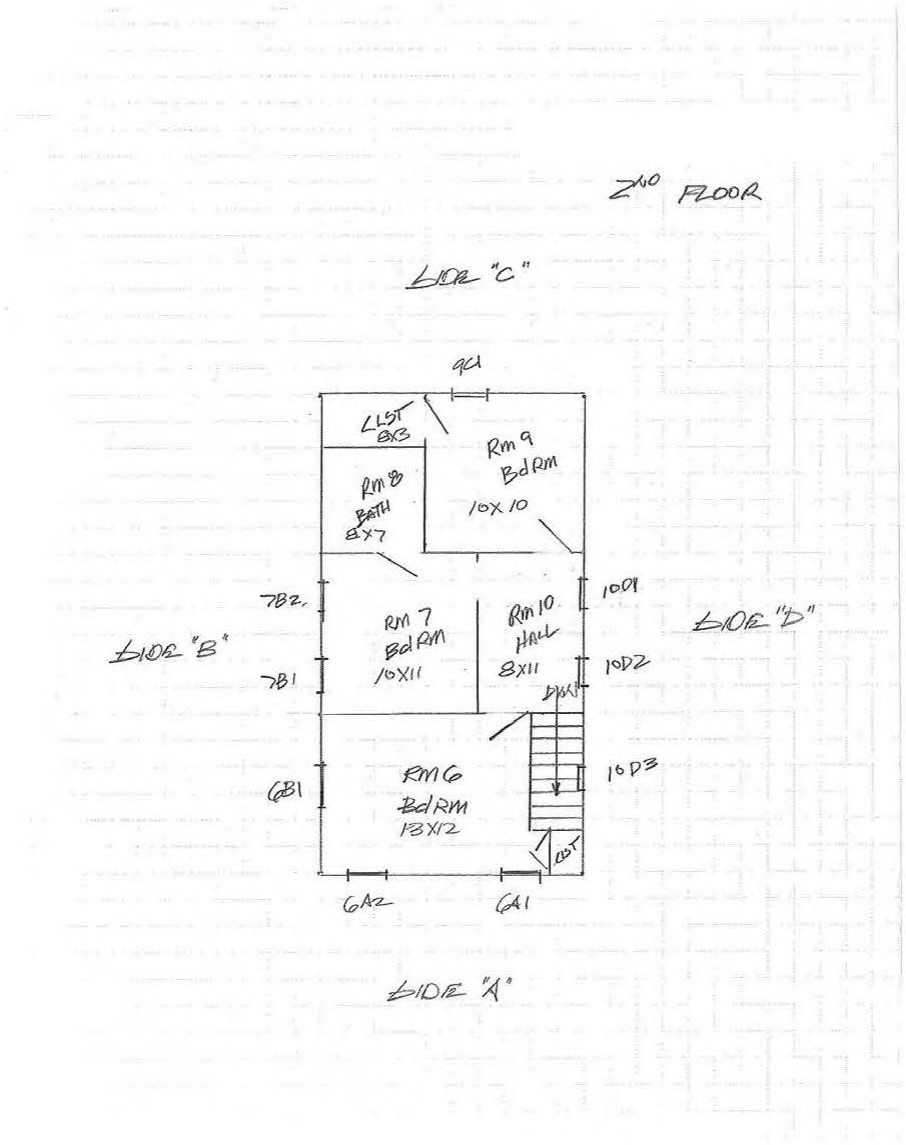
Contents

Property Drawings B1.2
Property Photos B2.2
Generic Risk Assessment B3.2
Order to Correct Condition of Premises..... B4.2
Examples of Placards B5.7

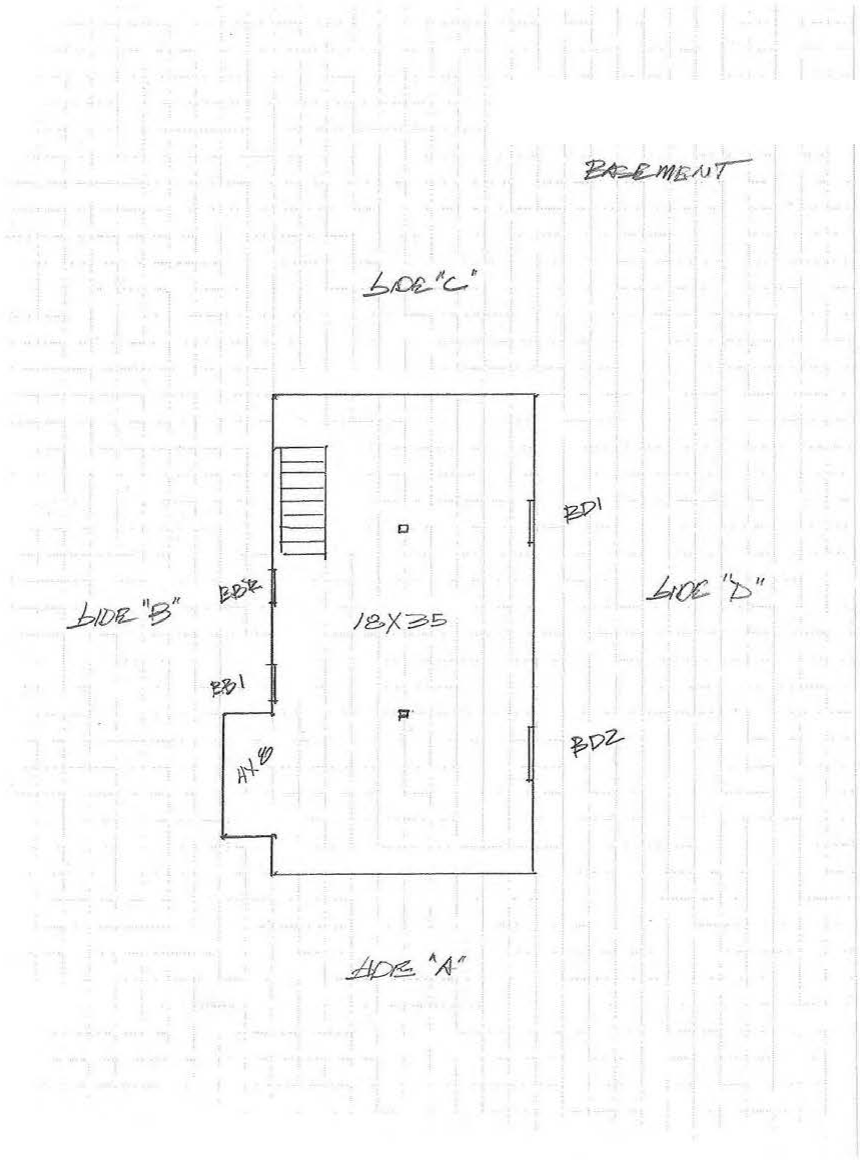
Property Drawings



Property Drawings (continued)



Property Drawings (continued)



Property Photos

Generic Risk Assessment

Lead Based Paint
Risk Assessment Report

Assessment Date: Month, Day, Year

Prepared for

Name
Address
Phone

For site located at

Address

Prepared by

Name
State of Wisconsin Certified
Lead Based Paint Risk Assessor #LRA- xxxx
Title
For:
ABC Local Health Department
Address
Telephone
Lead company number:

Description of Report

This report is the result of an investigation to identify and evaluate lead hazards in a dwelling where a child has been found with an elevated blood lead level. Wisconsin law requires health departments to investigate all dwellings occupied by children with elevated blood lead levels. This investigation used a lead based paint risk assessment to identify and evaluate lead based paint hazards and potential hazards at the dwelling. The information in this report is the basis for a Work Write Up for Orders to Correct the Lead Hazards. This investigation and risk assessment found only lead coatings to be lead hazards; the investigation found no other potential sources of lead exposure such as toys, hobbies, work or job exposure, dishes, food or water. The investigation focused on coatings which were either in damaged condition or in high risk locations such as friction

1

or impact surfaces. Locations and surfaces where the coatings were in good condition and which are not subject to wear, physical or weather damage were not tested for lead but should be monitored and maintained in good condition.

Lead paint/coatings and lead dust can be identified in a number of ways. In this assessment, lead paint on coatings and components was identified with a Manufacturer Name, Model name and number, X-ray Fluorescence Instrument, serial number xxxx. The instrument determines lead loading measured in milligrams per square centimeter of the coating on the tested component. The risk assessor checked the instrument's calibration before and after testing using a known quantity of lead on test films supplied by the manufacturer as well as paint film from the National Institute for Standards and Technology (NIST) and found the instrument to be working within manufacturer's specifications.

The risk assessor also took wipe samples to identify lead dust hazards and soil samples to identify lead in soil hazards.

This report identifies those areas where hazards exist and briefly describes the recommended action to address hazards in the columns on the right side of the tables in the assessment report. Detailed instructions describing the work needed to address the hazards are located in the Work Write Up for this dwelling. The Work Write Up for this dwelling is a part of the risk assessment report.

Unit Description and location/occupant use patterns

Owners: Name, Address, City, WI Zip code
Phone: xxx-yyy-zzzz

This is a moderately sized two story frame building occupied as a single family residence. Construction of original structure is shown in City records as built on or before 1900. Both floors are occupied for residential use. The original part of the unit has a basement. The rear add-on has a crawl space. Children spend the majority of their time in locations inside the unit or outside the building.

Results of visual inspection

The building is located in the "Marquette" neighborhood on the city's east side. This is primarily a residential neighborhood with some manufacturing and retail stores. The largest manufacturing facility in the neighborhood is an aluminum manufacturing facility located on the east border. Historically, the lead using facilities in the area were radiator repair shops and brass foundries which may have contributed lead emissions to the surrounding soil. Structurally, the building is in reasonably good condition with no obvious water leaks or structural defects. The roof, gutters and downspouts are in working order and the foundation has no cracks or breaks. There were areas of

deteriorated paint both on the interior and exterior of the building. There were areas of bare soil observed in the drip line around the perimeter of the house.

Deteriorated coatings were observed at the following locations and components:

Location 1 Front porch: all components except floor.
Location 2 Exterior: wood walls, wood trim, main windows, basement windows, entrance doors, gutters and downspouts.

First floor
Location 3 Entry and stairs, Rm 1: floor, door, baseboards, stairs and treads;
Location 4, Bedroom, Rm 2: windows, baseboards, doors, trim and ceiling;
Location 5, Rm 3, living room: windows, baseboards, ceilings, doors and trim;
Location 6, Rm 4, kitchen: windows, baseboards, door trim;
Location 7, Rm 5 dining room: walls, windows, door trim, basement door;
Location 8, Basement stairway: Baseboards, door and door trim, stair system;
Location 9, Basement: none except windows;

Second floor
Location 10, Rm 6, Bedroom: windows, floors, walls, baseboards, door and trim;
Location 11, Rm 7 Bedroom: baseboards, windows, doors and trim;
Location 12, Rm 8, Bathroom: ceiling, walls, baseboards, door and trim;
Location 13, Rm 9, Bedroom: floors, baseboards, window, closet door and trim;
Location 14, Rm 19, Upper Hall: floor, baseboards, windows, doors, trim and attic scuttle.

The risk assessment determined which deteriorated coatings and high risk components contain lead and thus constitute lead hazards.

Data Descriptions

XRF Readings

The X-ray fluorescence instrument (XRF) measures the lead per area on coated surfaces on specified locations and building components. In the State of Wisconsin any XRF reading with a value over 0.7 micrograms of lead per square centimeter is considered to show a lead bearing paint or coating.

Calibration Checks

The calibration of the XRF was checked each day prior to the start of testing and again at the end of testing. During calibration, the instrument is used to test films that have a known quantity of lead to ensure that the machine is functioning correctly. The paint films used were the manufacturer's film and the NIST Level III test film. The Manufacturer Model XXX ### Serial No. XYZ used for this assessment was consistently within calibration.

Dust Wipe Samples

Dust wipe samples were collected to determine dust lead loading on various surfaces. Ingestion of lead dust is considered to be the most common route of exposure in young children and the US Environmental Protection Agency (USEPA) has established levels above which are considered a hazard. They are described in micrograms per square foot (mcg/ft^2).

Floors……>40 mcg/ft^2
Window sills ……..>250 mcg/ft^2
Window wells……..> 400 mcg/ft^2

USEPA and US Housing and Urban Development Department (HUD) and State of Wisconsin Department of Health Services (DHS) established levels of lead dust that must be met before a lead project is considered complete and safe to occupy.

Floors……>40 mcg/ft^2
Window sills……>250 mcg/ft^2
Window wells……..> 400 mcg/ft^2

Chip or Scrape Samples

Samples of films or coatings may be collected and sent to a laboratory for analysis to determine the amount of lead content in the film or coating. In Wisconsin a film or coating is considered to be a lead paint or coating when analysis shows more than 0.06% of lead by weight or over 600 parts per million (ppm).

Soil Samples

Soil samples of bare soil areas are analyzed and reported in parts per million. Bare soil is considered hazardous if lead is 1200 ppm or more; bare soil in children's play areas is considered hazardous if the lead results are 400 ppm or more.

Varnished floors and trim

Varnish on floors, stairs, woodwork and trim may contain lead that is not detectable by an XRF instruments using the standard legal standards for xrf measures. In most cases where varnish floors or stairs are in poor condition with large areas of damage, it is recommended that they be cleaned and a clear-coat durable finish such as polyurethane be applied. A chip or scrape sample can be useful to determine lead content in situations where the XRF is not be able to measure lead in varnish. Lab analysis of bulk samples of varnish is more sensitive at identifying lead than measurements with XRF instruments. Lead in varnish can generate dangerous exposures to children and workers during

refinishing even if the lead is not detectable by XRF measurements.[1] Certified Lead Safe renovators should be used any time varnished floors or stairs are re-finished. Refinishing and sanding can cause large-scale lead dust hazards causing lead exposure to workers and occupants. Only trained and certified lead safe renovators should do this work. In this investigation, the risk assessor took dust wipe samples that identified high lead dust on floors. In the risk assessor's judgment, none of the other varnished surfaces in the dwelling were in sufficiently deteriorated condition to warrant testing with samples for laboratory analysis.

High Risk Components

The risk assessor tested certain components in intact condition as part of this assessment. These intact yet high risk components are described as follows:

Exterior high risk components include all coated accessible exterior surfaces including walls, porches, stairs, railings, columns, and door and window systems, accessible trim and coated play equipment.

Interior high risk components include window and door systems, floors, stair systems, railings and painted trim with a high potential for impact (e.g., baseboards).

- Porches (including porch walls, railings, columns, floors)
- Windows (including interior and exterior sashes, sills, wells, sash tracks and casings)
- Doors and door systems
- Floors
- Stair systems (treads, risers, landings, stringers, railings, balusters, columns)
- Accessible painted trim components (such as baseboards)
- Other intact surfaces that in the risk assessor's judgment are subject to friction, impact, or damage from moisture or weather conditions.

Soil Conditions

The soil conditions were fully accessible at the time of this assessment. Lead in soil can and often will be found along the drip line of buildings painted with lead paint. Bare soil areas that contain lead above the EPA standards are a hazard for children.

Location Specific Testing Results

Specific location testing results and descriptions of testing components follow in table format which contains information that provides the results of testing in each location. The Wall column refers to the wall of the component tested. The wall facing the address

[1] Schirmer,J. Havlena J, Jacobs DE, Dixon, S, Ikens, R. Lead exposures from varnished floor refinishing. *Journal of Occupational and Environmental Hygiene*, 9: 280–287. (2012)

street is referred to as "a" and the other walls follow in clockwise fashion. A number following identifies which similar component on the same wall from left to right (within the location) was tested. The Component column describes the component tested in that location and unless otherwise noted the result pertains to all similar components in a location. **Sample type is either X for XRF sample, D for Dust Sample, S for Soil Test, Ch for chip/scrape/bulk sample, or A for Assumed**. The assumed designation was used in those cases where previous samples taken of similar components with the same paint history were found to be positive and therefore are assumed to be positive in this location. The substrate refers to the underlying surface beneath the coated surface. The Result column provides the numerical result of the sample. "<LOD" is reported when a XRF result is less than the limit of detection. The next column labeled P/N/A summarizes that result as P for Positive, N for Negative or A for assumed to contain lead. The Treat Column answers the question of whether treatment is needed for this component and similar components. The final column provides a brief summary of the treatment recommended. Detailed treatments are provided in the Work Write Up for this dwelling.

Components that have no suspect coating, or are post 1980 such as replacement windows and doors are not sampled, as they would not contain lead. Walls that are covered with wallpaper or paneling and floors that are covered by carpet cannot be tested and should be assumed to contain lead paint if disturbed or renovated in the future, unless future inspection determines it is lead free.

In the results column, XRF results are described in milligrams of lead per square centimeter and dust sample results are described in micrograms of lead per square foot. Chip samples are referred to as percentage; for chips, a result greater than 0.06% (also expressed as 600 parts per million 600 ppm) by weight is considered to be lead containing. Soil samples are usually reported in parts per million (ppm) and results of 1200 ppm or more in bare soil areas or 400 ppm or more in children's play areas are lead soil hazards.

Dust lead results that are higher than the standards noted above must be treated or remediated as part of the work write ups provided for this dwelling unit. The contractors must achieve acceptable clearance results before the dwelling can be re-occupied. Therefore, although this write-up does not provide specific treatments for all high dust lead areas, the contractor must clean horizontal surfaces to achieve clearance and integrate and sequence the cleaning work towards the end of hazard reduction project.

Generic Risk Assessment (continued)

Outside Areas

Location 1 –Surrounding Yard Area

Wall	Component Type	Substrate	Condition	Sample Type	Result	P/N/A	Treat?	Treatment Description
A	Front Drip Line	Patches of Lawn Grass	Bare Soil	Composite Soil	1435 ppm	P	Y	Vacuum up visible paint chips. Obtain clearance Add two inches of mulch. .
B	Corner Drip Line	Patches of Lawn Grass	Bare Soil	Composite Soil	1783 ppm	P	Y	Vacuum up paint chips. Obtain clearance. Add two inches of mulch.

Location 1 Notes:

Results of composite soil samples represent lead in soil in bare soil areas . Paint chips were visible on the ground adjacent to the perimeter of the building. These areas must be thoroughly cleaned of visible paint chips and the contractor must contact the health department to request visual clearance and must pass visual clearance before adding mulch.

Location 2 – Building Exterior

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
A	Porch Column	Wood	10	X	2.1	P	Y	Stabilize and coat w / Acrylic
A	Porch Floor	Wood	None	X	<LOD	N	N	
A	Porch Skirt Bd	Wood	15	X	<LOD	N	N	
A	Porch Ceiling	Wood	150	X	6.7	P	Y	Stabilize and coat w / Acrylic
A	Porch Trim	Wood	25	X	3.4	P	Y	Stabilize and coat w / Acrylic
A	Porch Soffit	Wood	35	X	5.2	P	Y	Stabilize and coat w / Acrylic or Enclose w Aluminum Coil Stock
A	Porch fascia	Wood	20	X	2.6	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
A	Porch fascia Crown	Wood	20	X	1.7	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
A	Porch Wall Cladding	Wood	120	X	3	P	Y	Stabilize and coat w / Acrylic or Enclose W/ House Wrap and

7

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
	(siding)							Vinyl Siding
A	2A1 Window Trim	Wood	N.A.	X	34	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
A	2A1 Storm window	Wood	N.A.	X	8.2	P	Y	Discard all wooden storm windows
A	Entry Door Trim	Wood	N.A,	X	7.2	P	Y	Replace with door (see notes)
A	Storm Comb Door	Wood	20	X	<LOD	N	N	
A	Entry Slab	Wood	20	X	8.2	P	Y	Replace with pre-hung unit (see notes)
A	Entry Jamb	Wood	N.A.	X	2.6	P	Y	Replace with pre-hung unit
A	Entry Sill	Wood	1	X	1.4	P	Y	Stabilize + coat w acrylic or replace before installing new unit.
D	Fascia Bd trim	Wood	80	X	2.4	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
D	Fascia Crown Molding	Wood	N.A.	X	2.2	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
D	Soffit	Wood	120	X	13.3	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
D	Soffit Crown Molding	Wood	N.A.	X	23.6	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
D	Frieze Board	Wood	100	X	12.0	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
D	Siding	Wood	3000	X	20.5	P	Y	Option 1: Stabilize and coat w / Acrylic or Option 2: Enclose W/ House Wrap and Vinyl Siding.
D	Gutters and downspouts	Metal	15	X	11.2	P	Y	Replace
D	Window 10D2 Trim	Wood	5	X	18.3	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
D	Window 10D2 Exterior Blind	Wood	N.A.	X	1.5	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum

8

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
	Stop							
B	Window 2B1 jamb	Wood	N.A.	X	2.3	P	Y	Insert vinyl D/H Unit
B	Window 2B1 sash	Wood	N.A.	X	1	P	Y	Replace w / Vinyl D/H Unit
B	Window 2B1 trim	Wood	5	X	1.6	P	Y	Stabilize and coat w / Acrylic or Enclose with Aluminum
B	Side Exit Door Slab	Wood	20	X	.8	P	Y	Re-fit to frame and install bottom shoe, or replace with pre-hung unit
B	Side Exit Door Jamb	Wood	N.A.	X	1.1	P	Y	Re-fit Door and install Q-Lon wood or Metal. Stabilize and coat with acrylic or replace with pre-hung unit.
B	Side Exit Door Stop	Wood	N.A	X	1.3	P	Y	Replace with Q-Lon Metal or wood or replace with pre-hung unit.
B	Side Exit Door Sill	Wood	1	X	<LOD	N	N	
B	Basement Wall	Stone	0	X	<LOD	N	N	
B	Window BB1 Frame	Wood	N.A.	X	17.1	P	Y	Replace with glass block
B	Window BB1 Sash	Wood	5	X	14.4	P	Y	Replace with glass block
B	Vertical Board and Batten Siding	Wood	N.A.	X	2.5	P	Y	Stabilize and coat w / Acrylic or Enclose W/ House Wrap and Vinyl Siding.
C	Siding	Wood	3000	X	<LOD	P	Y	Stabilize and coat w / Acrylic or Enclose W/ House Wrap and Vinyl Siding.
C	Rear Exit Door Jamb	Wood	N.A.	X	<LOD	N	N	
C	Rear Exit Door Sill	Wood	N.A.	X	<LOD	N	N	

9

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
C	Rear Exit Stair tread	Wood	10	X	<LOD	N	N	
C	Rear Exit Stair Riser	Wood	10	X	<LOD	N	N	
C	Rear Exit Landing Floor	Wood	6	X	<LOD	N	N	
C	Rear Exit Railing	Wood	N.A.	X	<LOD	N	N	
C	Rear Railing post	Wood	N.A.	X	<LOD	N	N	

Location 2 Notes:

Most windows were unable to be tested from the outside, but all windows tested positive on the interior side. Sashes contain lead, at varying levels. All window sashes are common to the building and need to be replaced with new vinyl replacement units.
Basement window sash and frames are common to the building and need to be replaced, as all are accessible to children playing near the perimeter of the building.
The exterior exit doors are in poor condition. The front entry cannot be repaired or stabilized, and needs to be replaced. The side exit door has components which tested positive for lead, and can be safely treated to operate safely if properly maintained. If proper maintenance cannot be assured, then the positive units should be replaced with suitable factory pre-hung units.
The exterior siding and trim tested positive with varying amounts of lead. All outside siding and trim can be safely coated with acrylic paint, but will require monitoring and routine maintenance. If owner cannot assure proper ongoing monitoring and maintenance, the siding and trim must be enclosed with Aluminum and Vinyl, after proper sealing with house wrap.

Interior Areas

10

Generic Risk Assessment (continued)

First Floor

Location 3 – Rm 1 - Entry Hall and Stairway_

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
	Entry Floor	Hardwood	30	D	279	P	Y	Clean and seal for clearance
	Ceiling	Plaster	0	X	<LOD	N	N	
A	Wall	Plaster	0	X	10	N	N	
A	Entry Door Slab	Wood	20	X	<LOD	N	Y	See Notes
A	Entry Door Trim	Wood	N.A.	X	<LOD	N	Y	See Notes
B	Baseboard	Wood	5	X	<LOD	N	N	
D	Baseboard	Wood	3	X	<LOD	N	N	
C	Stair Riser	Wood	20	X	1.3	P	Y	Stabilize and coat with Acrylic. Cover with carpet or carpet runner
C	Treads	Wood	20	X	1.6	P	Y	Stabilize and coat with Acrylic. Cover with carpet or carpet runner
D	Stair Stringer	Wood	0	X	<LOD	N	N	
D	Newell Post	Wood	0	X	<LOD	N	N	
D	Baluster	Wood	0	X	<LOD	N	N	
D	Railing	Wood	0	X	<LOD	N	N	
B	Door 1-2 Trim	Wood	0	X	<LOD	N	N	
B	Door 1-2 Jamb	Wood	N.A.	X	1.1	P	N	Stabilize + coat w/ acrylic. Treat from Room 2.
C	Door 1-3 Trim	Wood	0	X	<LOD	N	N	
C	Door 1-3 Jamb	Wood	0	X	<LOD	N	N	

Location 3 Notes:

The entry door replacement is necessary due to poor condition and high lead found on outside readings.

11

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
D	Window 3D1Well	Wood	N.A	D	11,074	P	Y	Clean and insert vinyl replacement unit
D	Window 3D1 Sill	Wood	N.A.	D	1233	P	Y	Clean and Coat with Acrylic
	Ceiling	Plaster	6	X	.09	N	N	
D	Door 2-1 Trim	Wood	0	X	<LOD	N	N	
A	Baseboard	Wood	8	X	1.9	P	Y	Stabilize and coat w / Acrylic (impact surface)
B	Baseboard	Wood	3	X	2.4	P	Y	Stabilize and coat w / Acrylic
A	Win 2A2 Sash	Wood	N.A.	X	14.5	P	Y	Replace with vinyl pre-hung unit (exterior damage)
A	Win 2A2 Jamb	Wood	N.A.	X	1.3	P	Y	Replace with vinyl per-hung unit
A	Window 2A2 Sill	Wood	0	X D	<LOD A	N Y	Y	Clean and coat with acrylic based on high dust wipe result above
A	Win2A2 Stop	Wood	N.A.	X	2	P	Y	Replace with new unit (friction surface)
A	Win 2A2Trim	Wood	N.A.	X	1.6	P	Y	Stabilize and coat w / Acrylic
B	Window 2B1 Sash	Wood	N.A.	X	<LOD	P	Y	Replace with vinyl pre-hung unit (window exterior has lead)
B	Window 2B1 Jamb	Wood	N.A.	X	<LOD	P	Y	Replace with vinyl pre-hung unit (window exterior has lead)
B	Window 2B1 Sill	Wood	N.A.	X D	<LOD A	N Y	Y	Clean and coat with acrylic based on high dust wipe result above
B	Win 2B1 Stop	Wood	N.A.	X	1.3	P	Y	Replace with new unit
B	Win 2B1 Trim	Wood	N.A.	X	<LOD	N	N	
C	Door 2-3 Trim	Wood	N.A.	X	3.4	P	Y	Stabilize and coat w / Acrylic (friction and impact surfaces)
C	Door 2-3 Jamb	Wood	N.A.	X	4.2	P	Y	Stabilize and coat w / Acrylic (friction and impact surfaces)

All windows in the location are to be replaced with vinyl replacement units. Clear coat all sills (based on high dust results) so sills will be smooth, cleanable and likely to pass clearance. New wood stops should be installed with the units. Stabilize baseboards and door systems.

12

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat ?	Treatment Description
D	Window 3D1Well	Wood	N.A.	D	11,074	P	Y	Clean and insert vinyl replacement unit
D	Window 3D1 Sill	Wood	N.A.	D	1233	P	Y	Clean and Coat with Acrylic
	Ceiling	Plaster	10	X	<LOD	N	N	See Notes
A	Wall	Wood	0	X	<LOD	N	N	
B	Wall	Wood	0	X	<LOD	N	N	
C	Wall	Wood	0	X	<LOD	N	N	
D	Wall	Wood	0	X	<LOD	N	N	
A	Baseboard	Wood	5	X	17.4	P	Y	Stabilize and coat w / Acrylic (impact surface)
B	Baseboard	Wood	5	X	17.2	P	Y	Stabilize and coat w / Acrylic
C	Baseboard	Wood	6	X	16.8	P	Y	Stabilize and coat w / Acrylic
D	Baseboard	Wood	4	X	17.1	P	Y	Stabilize and coat w / Acrylic
	Closet Ceiling	Plaster	4	X	2.6	P	Y	Stabilize and coat w / Acrylic
B	Closet Wall	Plaster	0	X	<LOD	N	N	
D	Closet Wall	Plaster	0	X	<LOD	N	N	
B	Closet Baseboard	Wood	3	X	13.3	P	Y	Stabilize and coat w / Acrylic: impact surface
B	Closet Door Jamb	Wood	N.A.	X	3.6	P	Y	Stabilize and coat w / Acrylic
A	Closet Door Trim	Wood	N.A.	X	3.2	P	Y	Stabilize and coat w / Acrylic
B	Window 3B1 Sash	Wood	N.A.	X	3.4	P	Y	Replace w / vinyl D/H window unit
B	Window 3B1 Trim	Wood	N.A.	X	2.8	N	Y	Stabilize and coat w / Acrylic
B	Window 3B1Sill	Wood	N.A.	X D	<LOD N.A.	N A	N Y	Clean and coat with Acrylic (high dust lead on other sills)
B	Window 3B1 Stop	Wood	N.A.	X	5	P	Y	Replace with new unit

13

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat ?	Treatment Description
D	Window 3D1 Sash	Wood	N.A.	X	3.1	P	Y	Replace w / vinyl D/H replacement unit
D	Window 3D1 Jamb	Wood	N.A.	X	2.9	P	Y	Insert vinyl replacement unit to enclose hazard
D	Window 3D1 Stop	Wood	N.A.	X	1.4	P	Y	Replace with new unit
D	Window 3D1 Sill	Wood	N.A.	X D	<LOD N.A.	N A	N Y	Stabilize and coat w / Acrylic (high dust lead on other sills)
D	Window 3D1 Trim	Wood	N.A.	X	1.5	P	Y	Stabilize and coat w / Acrylic
C	Door 3-4 Jamb	Wood	N.A.	X	3.4	P	Y	Stabilize and coat w / Acrylic
C	Door 3-4 Trim	Wood	N.A.	X	9.2	P	Y	Stabilize and coat w / Acrylic

Location 5 – R3 - Living Room

Location 5 Notes:

Based on dust wipe sampling of windows and sills located in the unit, all double hung window wells and sills should be HEPA vacuumed and properly cleaned to remove accumulated dust prior to installing new units. All sills should then be re-coated with acrylic.
All windows in the location are original to the building, identical to those which tested positive on the exterior. Replace all window units.
The damaged plaster ceiling was tested although it is enclosed above the suspended ceiling system. The suspended ceiling system was not tested because it was in intact condition.

14

Generic Risk Assessment (continued)

Location 6 – Rm 4 Kitchen

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
D	Window 4D1 Well	Wood	N.A.	D	4788	P	Y	Clean and insert vinyl replacement window unit
D	Window 4D1 Sill	Wood	N.A.	D	414	P	Y	Clean and coat with acrylic
	4D1 Floor	Hard surface	0	D	33	N	N	
	Ceiling	Plaster	0	X	<LOD	N	N	
A	Wall	Plaster	0	X	<LOD	N	N	
B	Wall	Plaster	0	X	<LOD	N	N	
C	Wall	Plaster	0	X	<LOD	N	N	
D	Wall	Plaster	0	X	<LOD	N	N	
A	Wall Wainscoting	Wood	0	X	<LOD	N	N	
B	Cabinet Box	Wood	0	X	<LOD	N	N	
B	Cabinet Frame	Wood	0	X	<LOD	N	N	
B	Cabinet Door	Wood	0	X	<LOD	N	N	
B	Cabinet Drawer	Wood	0	X	<LOD	N	N	
C	Baseboard	Wood	4	X	18.5	P	Y	Stabilize and coat with acrylic
D	Baseboard	Wood	3	X	20.4	P	Y	Stabilize and coat with Acrylic
A	Door 4-3Trim	Wood	N.A.	X	21.2	P	Y	Stabilize and coat with Acrylic
D	Window 4D1 Sash	Wood	N.A.	X	18.2	P	Y	Replace with Vinyl D/H replacement unit
D	Window 4D1 Jamb	Wood	N.A.	X	14.3	P	Y	Enclose with Vinyl D/H replacement unit
D	Window 4D1 Sill	Wood	N.A.	X	<LOD	N	Y	See notes and note high dust lead on sills. Also the margin of error for the xrf exceeded the lead standard.

15

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
D	Window 4D1 Stop	Wood	N.A.	X	1.8	P	Y	Replace with new unit
D	Window 4D1 Trim	Wood	N.A.	X	15.8	P	Y	Stabilize and coat with Acrylic
C	Door 4-5 Jamb	Wood	N.A.	X	1.2	P	Y	Stabilize and coat with Acrylic
C	Door 4-5 Trim	Wood	N.A.	X	1	P	Y	Stabilize and coat with Acrylic
C	Window 4C1 Sash	Wood	N.A.	X	<LOD	P	Y	Replace with Vinyl D/H replacement unit
C	Window 4C1 Jamb	Wood	N.A.	X	2.7	P	Y	Enclose with Vinyl D/H replacement unit
C	Window 4C1 Sill	Wood	N.A.	X	<LOD	N	Y	See notes
C	Window 4C1 Stop	Wood	N.A.	X	3.4	P	Y	Replace with new unit
C	Window 4C1 Trim	Wood	N.A.	X	19.1	P	Y	Stabilize and coat with Acrylic

Location 6 Notes:

Based on dust wipe sampling, all double hung window wells and sills should be HEPA vacuumed and cleaned to remove the hazard of accumulated dust prior to installing new unit. All sills should then be re-coated with Acrylic.
All windows in the location are original to the building, and are identical to those which tested positive on exterior. Replace all units.

16

Generic Risk Assessment (continued)

Location 7 – Rm 5 – Dining Room

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
B	Window 5B1Sill	Wood	N.A.	D	344	P	Y	Stabilize and coat with acrylic
B	5B1 Floor	Hard Surface	0	D	25	N	N	
	Ceiling	Plaster	1	X	<LOD	N	N	
A	Wall	Wood	6	X	0.9	P	Y	Stabilize and coat with Acrylic
B	Wall	Wood	12	X	1.3	P	Y	Stabilize and coat with Acrylic
C	Wall	Wood	6	X	1.5	P	Y	stabilize and coat with Acrylic
D	Wall	Wood	10	X	.9	P	Y	Stabilize and coat with Acrylic
A	Door 5-4 Trim	Wood	N.A.	X	1.5	P	Y	Stabilize and coat with Acrylic
A	Closet Door Jamb	Wood	N.A.	X	1.1	P	Y	Stabilize and coat with Acrylic
A	Closet Door Trim	Wood	N.A.	X	1.4	P	Y	Stabilize and coat with Acrylic
C	Closet Door Trim	Wood	N.A.	X	1.3	P	Y	Stabilize and coat with Acrylic
D	Closet wall	Wood	1	X	<LOD	N	N	
	Closet Ceiling	Plaster	0	X	<LOD	N	N	
A	Bsmnt Door Slab	Wood	6	X	12.5	P	Y	Replace with pre-hung unit
A	Bsmnt Door Jamb	Wood	N.A.	X	11.6	P	Y	Replace with pre-hung unit
A	Bsmnt Door Trim	Wood	N.A.	X	14.5	P	Y	Replace with door unit

Location7 Notes:

17

Closet door jamb and trim components should be stabilized and coated with Acrylic.
Based on dust wipe sampling of windows located in the unit, all double hung window wells should be HEPA vacuumed and cleaned to remove the hazard of accumulated dust. Clear coat all sills. All windows in the location are original to the building, and are similar to those which tested positive. All units should be replaced.

Location 8 – Basement Stairway

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
	Ceiling	Plaster	0	X	<LOD	N	N	
A	Wall	Plaster	0	X	<LOD	N	N	
B	Wall	Plaster	0	X	<LOD	N	N	
D	Wall	Plaster	0	X	<LOD	N	N	
C	Bsmnt Door Trim	Wood	N.A.	X	1.4	P	Y	Replace with door unit.
B	Baseboard	Wood	2	X	2.2	P	Y	Stabilize and coat with Acrylic
B	Stair Ledge	Wood	1	X	<LOD	N	N	
C	Riser	Wood	4	X	<LOD	N	N	
C	Tread	Wood	12	X	.9	P	Y	Stabilize and coat with Acrylic and cover
B	Stringer	Wood	2	X	<LOD	N	N	
D	Stringer	Wood	2	X	<LOD	N	N	

Location 8 Notes: *Replace door system and stabilize baseboards and stair treads.*

Location 9 – Basement

Location 9 Notes:

All components in the basement location were unpainted and were not tested. Windows tested positive from the exterior; no other hazards were found. All basement windows are original to the building, and should be replaced with glass block units fit to the masonry openings.

18

Second Floor

Location 10 – Rm 6 – Bedroom

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
	6A1 Floor	Wood	8	D	150	P	Y	Clean and seal w acrylic floor paint
A	6A1 Sill	Wood	N.A.	D	917	P	Y	Clean and coat with Acrylic
A	6A1 Well	Wood	N.A.	D	34198	P	Y	Clean and insert vinyl replacement window unit
	Ceiling	Plaster	0	X	<LOD	N	N	
A	Wall	Plaster	4	X	1	P	Y	Stabilize and coat with Acrylic
B	Wall	Plaster	4	X	.7	P	Y	Stabilize and coat with Acrylic
C	Wall	Wood	1	X	<LOD	N	N	
D	Wall	Plaster	4	X	0.8	P	Y	Stabilize and coat with Acrylic. See notes
C	Alcove Wall	Plaster	3	X	1.2	P	Y	Stabilize and coat with Acrylic
D	Closet Wall	Plaster	1	X	<LOD	N	N	
D	Closet Door frame	Wood	0	X	<LOD	N	N	
D	Closet Door	Wood	0	X	<LOD	N	N	
D	Closet Trim	Wood	N.A.	X	0.9	P	Y	Stabilize and coat with Acrylic
C	Closet Trim	Wood	N.A.	X	0.8	P	Y	Stabilize and coat with Acrylic. See notes
D	Closet drawer	Wood	0	X	<LOD	N	N	
	Floor	Wood	25	X	1.2	P	Y	Stabilize and coat with Acrylic
A	Baseboard	Wood	4	X	22.4	P	Y	Stabilize and coat with Acrylic
B	Baseboard	Wood	4	X	22.7	P	Y	Stabilize and coat with Acrylic
C	Baseboard	Wood	4	X	23.6	P	Y	Stabilize and coat with Acrylic
D	Baseboard	Wood	4	X	24.2	P	Y	Stabilize and coat with Acrylic
A	Alcove Corner Bead	Wood	0	X	<LOD	N	N	
A	Window 6A1 Sash	Wood	N.A.	X	1.2	P	Y	Replace with vinyl D/H replacement unit (Note that window exterior surfaces are damaged.)
A	Window 6A1 Jamb	Wood	N.A.	X	5.4	P	Y	Enclose with vinyl D/H replacement unit
A	Window 6A1 Sill	Wood	N.A.	X	<LOD	N	Y	Clean and coat with Acrylic (See high dust lead on other sills)

19

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
A	Win 6A1 Stop	Wood	N.A.	X	2.3	P	Y	Replace with new unit
A	Win 6A1 Trim	Wood	N.A.	X	1	P	Y	Stabilize and coat with Acrylic
A	Win 6A2 Sash	Wood	N.A.	X	2.7	P	Y	Replace with vinyl D/H replacement unit
A	Win 6A2 Jamb	Wood	N.A.	X	3.3	P	Y	Enclose with vinyl D/H replacement unit
A	Window 6A2 Sill	Wood	N.A.	X	4.4	P	Y	Clean and coat with Acrylic (see high dust lead on other sills.)
A	Win 6A2 Trim	Wood	N.A.	X	.7	P	Y	Stabilize and coat with Acrylic
B	Win 6B1 Sash	Wood	N.A.	X	2.2	P	Y	Replace with vinyl D/H replacement unit
B	Win 6B1 Jamb	Wood	N.A.	X	4.3	P	Y	Enclose with vinyl D/H replacement unit
B	Window 6B1 Sill	Wood	N.A.	X	1.5	P	Y	Clean and coat with Acrylic (see high dust lead on other sills)
B	Window 6B1 Stop	Wood	N.A.	X	2.5	P	Y	Replace with new unit
B	Window 6B1 Trim	Wood	N.A.	X	1.1	P	Y	Stabilize and coat with Acrylic
C	Door 6-10 Slab	Wood	6	X	4.3	P	Y	Replace with pre-hung unit
C	Door 6-10 Jamb	Wood	N.A.	X	3.8	P	Y	Replace with pre-hung unit
C	Door 6-10 Threshold	Wood	3	X	2.6	P	Y	Replace
C	Door 6-10 Stop	Wood	N.A.	X	3.6	P	Y	Replace with pre-hung unit
C	Door 6-10 trim	Wood	N.A.	X	1.1	P	Y	Stabilize and coat with Acrylic or replace

Location 10 Notes:

Most woodwork and trim in this location had positive readings.

20

Generic Risk Assessment (continued)

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
A	Win 6A1 Stop	Wood	N.A.	X	2.3	P	Y	Replace with new unit
A	Win 6A1 Trim	Wood	N.A.	X	1	P	Y	Stabilize and coat with Acrylic
A	Win 6A2 Sash	Wood	N.A.	X	2.7	P	Y	Replace with vinyl D/H replacement unit
A	Win 6A2 Jamb	Wood	N.A.	X	3.3	P	Y	Enclose with vinyl D/H replacement unit
A	Window 6A2 Sill	Wood	N.A.	X	4.4	P	Y	Clean and coat with Acrylic (see high dust lead on other sills.)
A	Win 6A2 Trim	Wood	N.A.	X	.7	P	Y	Stabilize and coat with Acrylic
B	Win 6B1 Sash	Wood	N.A.	X	2.2	P	Y	Replace with vinyl D/H replacement unit
B	Win 6B1 Jamb	Wood	N.A.	X	4.3	P	Y	Enclose with vinyl D/H replacement unit
B	Window 6B1 Sill	Wood	N.A.	X	1.5	P	Y	Clean and coat with Acrylic (see high dust lead on other sills)
B	Window 6B1 Stop	Wood	N.A.	X	2.5	P	Y	Replace with new unit
B	Window 6B1 Trim	Wood	N.A.	X	1.1	P	Y	Stabilize and coat with Acrylic
C	Door 6-10 Slab	Wood	6	X	4.3	P	Y	Replace with pre-hung unit
C	Door 6-10 Jamb	Wood	N.A.	X	3.8	P	Y	Replace with pre-hung unit
C	Door 6-10 Threshold	Wood	3	X	2.6	P	Y	Replace
C	Door 6-10 Stop	Wood	N.A.	X	3.6	P	Y	Replace with pre-hung unit
C	Door 6-10 trim	Wood	N.A.	X	1.1	P	Y	Stabilize and coat with Acrylic or replace

Location 10 Notes:

Most woodwork and trim in this location had positive readings.

20

Generic Risk Assessment (continued)

Location 11 – Rm 7 Bedroom

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
	Ceiling	Plaster	1	X	<LOD	N	N	
A	Wall	Plaster	0	X	<LOD	N	N	
B	Wall	Plaster	0	X	<LOD	N	N	
C	Wall	Plaster	0	X	<LOD	N	N	
D	Wall	Plaster	0	X	<LOD	N	N	
A	Baseboard	Wood	3	X	21.8	P	Y	Stabilize and coat with Acrylic
B	Baseboard	Wood	3	X	23.4	P	Y	Stabilize and coat with Acrylic
C	Baseboard	Wood	3	X	22	P	Y	Stabilize and coat with Acrylic
D	Baseboard	Wood	3	X	21.6	P	Y	Stabilize and coat with Acrylic
	Floor	Wood	80	X	1.4	P	Y	Stabilize and coat with Acrylic
B	Win 7B2 Sash	Wood	N.A.	X	24.7	P	Y	Replace w / vinyl D/H window unit
B	Win 7B2 Jamb	Wood	N.A.	X	5.6	P	Y	Insert vinyl replacement unit to enclose hazard
B	Window 7B2 Sill	Wood	N.A.	X	<LOD	P	Y	Stabilize and coat with Acrylic (see high dust lead on other sills)
B	Win 7B2 Stop	Wood	N.A.	X	4.5	P	Y	Replace with new unit
B	7B2 Trim	Wood	N.A.	X	20.8	P	Y	Stabilize and coat with Acrylic
C	Door 7-8 Slab	Wood	5	X	22	P	Y	Replace with pre-hung unit
C	Door 7-8 Trim	Wood	N.A.	X	24.2	P	Y	Stabilize and coat with Acrylic or replace with unit
D	Door 7-10 Jamb	Wood	N.A.	X	19.1	P	Y	Replace with pre-hung unit
D	Door 7-10 Stop	Wood	N.A.	X	2.2	P	Y	Replace with new unit
D	Door 7-10 Trim	Wood	N.A.	X	22.1	P	Y	Stabilize and coat with Acrylic or replace with unit

Location 11 Notes:

21

Based on dust wipe sampling, all double hung window wells should be HEPA vacuumed and cleaned to remove the hazard of accumulated dust prior to inserting new unit. All windows in the location are original to the building, and are identical to those which tested positive from exterior. Replace all window units.

Location 12 – Rm 8 - Bathroom

Wall	Component Type	Substrate	**Area of Deteriorated paint (Sq. ft.)**	Sample Type	Result	P/N/A	Treat?	Treatment Description
	Ceiling	Plaster	45	X	1.8	P	Y	Stabilize and coat with Acrylic
A	Wall	Plaster	4	X	2.2	P	Y	Stabilize and coat with Acrylic (See notes)
B	Wall	Plaster	4	X	2.5	P	Y	Stabilize and coat with Acrylic (See notes)
C	Wall	Plaster	5	X	2.1	P	Y	Stabilize and coat with Acrylic
D	Wall	Plaster	4	X	1.7	P	Y	Stabilize and coat with Acrylic
A	Baseboard	Wood	2	X	5.7	P	Y	Stabilize and coat with Acrylic (See notes)
C	Baseboard	Wood	3	X	8.6	P	Y	Stabilize and coat with Acrylic
D	Baseboard	Wood	3	X	15.2	P	Y	Stabilize and coat with Acrylic
A	Door 8-7 Slab	Wood	4	X	21.6	P	Y	Replace with pre-hung unit; treat from Room 7
A	Door 8-7 Stop	Wood	N.A.	X	3.3	P	Y	Replace with new unit
A	Door 8-7 Trim	Wood	N.A.	X	2.8	P	Y	Stabilize and coat with Acrylic or replace with new unit

Location 12 Notes:

Positive readings indicate the ceiling, walls and woodwork should be treated.

Generic Risk Assessment (continued)

Location 13 – Rm 9 - Bedroom

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
	Ceiling	Plaster	2	X	0.5	N	N	
A	Wall	Plaster	0	X	<LOD	N	N	
B	Wall	Plaster	0	X	.12	N	N	
C	Wall	Plaster	0	X	<LOD	N	N	
D	Wall	Plaster	0	X	<LOD	N	N	
	Floor	Wood	85	X	1	P	Y	Stabilize and coat with Acrylic
A	Baseboard	Wood	4	X	20.4	P	Y	Stabilize and coat with Acrylic
B	Baseboard	Wood	3	X	18.7	P	Y	Stabilize and coat with Acrylic
C	Baseboard	Wood	5	X	22.9	P	Y	Stabilize and coat with Acrylic
D	Baseboard	Wood	5	X	18.5	P	Y	Stabilize and coat with Acrylic
C	Window 9C1 Sash	Wood	N.A.	X	22.4	P	Y	Replace with vinyl D/H window unit
C	Win 9C1 Jamb	Wood	N.A.	X	<LOD	P	Y	Insert vinyl replacement unit to enclose hazard
C	Window 9C1 Sill	Wood	N.A.	X	4.9	P	Y	Stabilize and coat with Acrylic
C	Window 9C1 Stop	Wood	N.A.	X	3.8	P	Y	Replace with new unit
C	Window 9C1 Trim	Wood	N.A.	X	2.4	P	Y	Stabilize and coat with Acrylic
	Closet Ceiling	Plaster	0	X	.16	N	N	
A	Closet Wall	Plaster	1	X	<LOD	N	N	
C	Closet Wall	Plaster	1	X	<LOD	N	N	
C	Closet Trim	Wood	N.A.	X	2.4	P	Y	Stabilize and coat with Acrylic
A	Closet Baseboard	Wood	3	X	4.9	P	Y	Stabilize and coat with Acrylic
	Closet Floor	Wood	6	X	1.4	P	Y	Stabilize and coat with Acrylic
B	Closet Door Slab	Wood	8	X	3.2	P	Y	Replace with pre-hung unit
B	Closet Door Jamb	Wood	N.A.	X	21.6	P	Y	Replace with pre-hung unit
B	Closet Door threshold	Wood	N.A.	X	2.9	P	Y	Replace with new unit
A	Closet Plumbing	Metal	N.A.	X	<LOD	N	N	
A	Door 9-10 Slab	Wood	8	X	16.8	P	Y	Replace with pre-hung unit
A	Door 9-10 Jamb	Wood	N.A.	X	24	P	Y	Replace with Pre-hung unit
A	Door 9-10 Stop	Wood	N.A.	X	18.1	P	Y	Replace with new unit
A	Door 9-10 Threshold	Wood	N.A.	X	<LOD	N	N	

Location 13 Notes:

Based on the positive readings found on the window, the floors, baseboards, doors and other components, all positive trim that is not replaced should be coated with acrylic.

23

Generic Risk Assessment (continued)

Location 14 – Rm 10 – Upper Hall

Wall	Component Type	Substrate	Area of Deteriorated paint (Sq. ft.)	Sample Type	Result	P/N/A	Treat?	Treatment Description
D	10D1 Floor	Wood	60	D	127	P	Y	Stabilize and coat with Acrylic
D	10D1 Sill	Wood	N.A.	D	1268	P	Y	Stabilize and coat with Acrylic
	Ceiling	Plaster	0	X	<LOD	N	N	
A	Wall	Plaster	0	X	<LOD	N	N	
B	Wall	Plaster	0	X	<LOD	N	N	
D	Wall	Plaster	0	X	<LOD	N	N	
A	Baseboard	Wood	4	X	1.5	P	Y	Stabilize and coat with Acrylic
B	Baseboard	Wood	6	X	1.7	P	Y	Stabilize and coat with Acrylic
C	Baseboard	Wood	3	X	19.1	P	Y	Stabilize and coat with Acrylic
D	Baseboard	Wood	3	X	19.9	P	Y	Stabilize and coat with Acrylic
D	Win 10D1 Sash	Wood	N.A.	X	<LOD	N	Y	Replace w vinyl D/H window (exteriors positive)
D	Win 10D1 Jamb	Wood	N.A.	X	7.8	P	Y	Insert vinyl replacement unit
D	Win 10D1 Sill	Wood	N.A.	X	<LOD	N	Y	Stabilize w Acrylic (high lead dust on other sills)
D	Win 10D1 Stop	Wood	N.A.	X	4.6	P	Y	Replace with new unit
D	Win10D1 Trim	Wood	N.A.	X	2.2	P	Y	Stabilize and coat with Acrylic
D	Win 10D2 Sash	Wood	N.A.	X	23.4	P	Y	Replace with vinyl D/H window unit
D	Win 10D2 Jamb	Wood	N.A.	X	4.7	P	Y	Insert vinyl replacement unit
D	Win10D2 Sill	Wood	N.A.	X	<LOD	N	Y	Stabilize + coat w/ Acrylic (See notes)
D	Win 10D2 Stop	Wood	N.A.	X	4.8	P	Y	Replace with new unit
D	Win 10D2 Trim	Wood	N.A.	X	1	P	Y	Stabilize and coat with Acrylic
D	Win 10D3 Sash	Wood	N.A.	X	1.5	P	Y	Replace with vinyl D/H window unit
D	Win 10D3 Jamb	Wood	N.A.	X	3.9	P	Y	Insert vinyl replacement unit
D	Win 10D3 Sill	Wood	N.A.	X	<LOD	N	Y	Stabilize + coat w/ Acrylic (See notes)
D	Win 10D3 Stop	Wood	N.A.	X	6.3	P	Y	Replace with new unit
D	Win 10D3 Trim	Wood	N.A.	X	4.5	P	Y	Stabilize and coat with Acrylic
B	Door 10-7 Trim	Wood	N.A.	X	1.9	P	Y	Stabilize and coat with Acrylic
C	Door 10-9 Trim	Wood	N.A.	X	19.3	P	Y	Stabilize and coat with Acrylic
A	Door 10-6 Trim	Wood	N.A.	X	2.4	P	Y	Stabilize and coat with Acrylic
	Attic Scuttle	Wood	3	X	1.8	P	Y	Stabilize and coat with Acrylic
	Attic Scuttle Jamb	Wood	N.A.	X	1.5	P	Y	Coat with other components
	Attic Scuttle Door	Wood	3	X	1.9	P	Y	Stabilize and coat with Acrylic

24

Generic Risk Assessment (continued)

Location 14 Notes:

Based on dust wipe sampling of windows located in the unit, all double hung window wells should be HEPA vacuumed and properly cleaned to remove the hazard of accumulated dust lead prior to inserting new units. Clean and stabilize all sills to reduce dust lead loading to ensure clearance.
All windows in the location are original to the building, and identical to those which tested positive on exterior. Replace all units.

25

Summary of Work needed to correct the lead hazards

See work write up/specifications for detailed descriptions of the required work.

It is important that the building components found to contain lead paint or which were untested, be maintained in good condition and periodically re-inspected to ensure that they stay in good condition. Roofs, gutters, downspouts and flashing should be kept in good proper working condition to ensure that unintended water/moisture does not enter the building. Any peeling, flaking, chipping or other deterioration of surfaces which contain lead paint or have not been proven to be lead free should be repaired or repainted in a lead safe manner by certified lead safe renovators.

Disclaimers

The information in this report represents conditions as they were found on the day of the risk assessment and does not reflect the conditions before or after. The dwelling is located at Street address, City, WI.

Generic Risk Assessment (continued)

HUD 2012 Guidelines **CHAPTER 5: RISK ASSESSMENT AND REEVALUATION** ----------

Form 5.1 Building Condition Form for Lead Hazard Risk Assessment.

Property address __ZZZ Street, City, State, Zip

Apt.No. ----------

Name of property owner YYY ---------- Name of risk assessor _____

Date of assessment: ____ /___ / ___

Condition	Yes	No	Comments
Roof missing parts of surfaces (tiles, boards, shakes, etc.)		X	
Roof has holes or large cracks		X	
Gutters or downspouts broken		X	
Chimney masonry cracked, bricks loose or missing, obviously out of plumb		X	
Exterior or interior walls have obvious large cracks or holes, requiring more than routine pointing (if masonry) or painting		X	
Exterior siding has missing boards or shingles		X	
Water stains on interior walls or ceilings		X	
Walls or ceilings deteriorated	X		
More than "very small" amount of paint in a room deteriorated	X		
Two or more windows or doors broken, missing, or boarded up		X	
Porch or steps have major elements broken, missing, or boarded up		X	
Foundation has major cracks, missing material, structure leans, or visibly unsound		X	
**Total number	2		

*The "very small" amount is the *de minimis* amount under the HUD Lead Safe Housing Rule (24 CFR 35.1350(d)), or the amount of paint that is not "paint in poor condition" under the EPA lead training and certification("402") rule (40 CFR 745.223).

Notes (including other conditions of concern):

27

Order to Correct Condition of Premises

ORDER TO CORRECT CONDITION OF PREMISES

XYZ LHD
STREET ADDRESS
CITY, WI ZIP CODE

Date:

To:

Address of premises found with conditions in violation of state law:
Date of investigation:
Order number: (if applicable)

Dear Sir or Madam,

Mr. or Ms……a certified RA or certified hazard investigator (certification number ….employed by lead company number ...) for the xyz local or county health department, conducted an investigation for lead hazards at the premises on (date). This investigation was conducted under the authority of Wisconsin Statute § 254.166. The purpose of the investigation was to identify and evaluate lead hazards on the premises that could have contributed to a child's lead exposure resulting in an EBLL.

A child living at this property has been reported to have an EBLL. An elevated blood lead means a level of lead in blood that is any of the following: (a) twenty or more micrograms per 100 milliliters of blood, as confirmed by one venous blood test. Or (b) fifteen or more micrograms per 100 milliliters of blood, as confirmed by 2 venous blood tests that are performed as least 90 days apart.

Based on this investigation, lead coatings were found to contain lead (in excess of the definitions of lead bearing paint) which present lead hazards based on their condition, location or use. The dust samples and coating materials were tested for lead by the Wisconsin Occupational Health Laboratory and with a calibrated x ray fluorescence instrument manufactured by RMD Instruments, Model LPA-1, Serial number 1098. Lead hazards are present when coatings contain lead and this coating is either in deteriorating condition or the coating is located on a friction, impact or accessible surface.

Lead contaminated bare soil was found that is also a hazard. **A copy of the Investigation for Lead Hazards including a detailed Work Write Up Scope of Work is enclosed as Enclosure 1. According to city records you are the owner of this dwelling, so therefore you must correct these lead hazards.**

Order to Correct Condition of Premises (continued)

[Optional language: Note that because of these conditions, the property is untenantable. Therefore the tenant has certain rights under state law, Wisconsin Statute § 704.07.]

You must use a certified lead abatement company to do this work. Abatement is defined by Chapter DHS 163 of the Wisconsin Administrative Code as "any set of measures designed to permanently eliminate LBP hazards, such as the on-site removal of LBP and lead contaminated dust, the permanent enclosure or encapsulation of LBP, the replacement of lead painted surfaces or fixtures and the removal or covering of lead contaminated soil, and all preparation, cleanup, disposal and post abatement clearance testing activities associated with those measures."

To find a list of certified contractors or to find out how to become a certified contractor, please 608 261-6876. Lead Abatement contractors must also notify the state DHS before beginning work on this project as required by WI DHS 163.14 regulations.

(Optional language: If you elect to use interim control measures such as cleaning and repainting, rather than conduct abatement work, you must use a certified lead safe renovator. Interim control activity is defined as "any activity designed to temporarily reduce human exposure or likely exposure to LBP hazards, including specialized cleaning, repair, maintenance, painting, temporary containment, or ongoing monitoring of lead based hazards or potential hazards." For names of lead safe renovators, contact 608 261-6876.)

You must notify the health department of the start dates for this work before this work is done so that the health department can monitor the job to ensure that work is done properly.

You must also notify the health department when the work is completed, so that the health department can come back to conduct a clearance investigation to ensure that the required work has been done properly and that the dwelling is safe for re-occupancy.

This work must be completed within 30 days. Failure to correct these conditions within 30 days will result in a referral to the District Attorney for civil or criminal penalties up to $5,000, per day, per violation and up to two years probation.

If you choose to rent the premises before the hazards are corrected, you are at risk for a civil lawsuit for damages that may arise as a result of deteriorated paint at these premises. *Furthermore, if you rent this dwelling after the health department has declared it untenantable, you may be criminally prosecuted for violations of Wisconsin law.*

Order to Correct Condition of Premises (continued)

You may be able to secure financial assistance to help you with correcting these lead hazards from a commercial bank or lender. You may also be able to identify other sources of financial assistance by consulting the Housing Guides prepared by the Wisconsin Division of Housing within the Wisconsin Department of Administration. For owner occupied properties, the guide is located on-line at

http://doa.wi.gov/docview.asp?docid=9089&locid=173

For rental properties, the guide is located at
http://doa.wi.gov/docview.asp?docid=9090&locid=173

The RA or hazard investigator can meet with you within the next three days at the property to discuss the hazards and the necessary corrective actions. Note that it is illegal and dangerous for you to attempt to correct these hazards unless you have the proper training, certification and tools. Please call ..... to schedule an onsite meeting.

You have a right to appeal this order. To receive a review of this determination, under Wisconsin Statute Chapter 68, you must send a written request for a review within thirty days of the date of this letter under Wisconsin Statutes 68.09. Requests for review must be made in writing to the municipality or county which ordered the corrective action taken. You have additional rights for administrative appeals, hearings and judicial review as described in Chapter 68.

Federal law requires that you provide copies of this order and the Enclosure describing the Investigation for Lead Hazards and the Scope of Work, to all parties who seek to rent or purchase this property. The federal Residential LBP Hazard Reduction Act, 42 U.S.C. 4852d, requires sellers and landlords of most residential housing built before 1978 to disclose all available records and reports concerning LBP and/or LBP hazards, including the test results contained in this notice, to purchasers and tenants at the time of sale or lease or upon lease renewal. This disclosure must occur even if hazard reduction or abatement has been completed. Failure to disclose these test results is a violation of the U.S. Department of Housing and Urban Development and the U.S. Environmental Protection Agency regulations at 24 CFR part 35 and 40 CFR part 745 and can result in a fine of up to $11,000/violation. You may call (800) 424-5323 to find out more information about your obligations under federal LBP disclosure requirements.

The following lead hazards need to be treated so that the house is lead safe:

- **Exterior surfaces of the house including the front porch**
- **Windows, including both exterior and interior including trim and casings**
- **Floors, excluding the kitchen, dining room and bathroom**
- **Side entry door systems**
- **Door systems including all upstairs doors**

Order to Correct Condition of Premises (continued)

- Baseboards
- Door jambs and trim
- Stair tread and risers going upstairs and stair treads to the basement
- Walls in the upstairs master bedroom, boys bedroom, bathroom and hallway
- Ceiling in the bathroom

There may be other surface coatings at this dwelling that also contain lead that were not identified in this investigation. Consult the HUD Lead Paint Safety Field Guide for guidance about how to safely maintain your property in the future after you have complied with this order. For copies see the following web site:

http://www.hud.gov/offices/lead/training/LBPguide.pdf

Per Health Officer

By: Name of Hazard Investigator:

Enclosures:

Order to Correct Condition of Premises (continued)

PROOF OF SERVICE

I hereby certify that on the ___number_of_day, of ___month____, year, at the City of _____, Wisconsin, I duly served an order of which this is a true copy upon , (name of owner _____),

By the following method (circle one of three)

1. **My mailing by certified mail to the defendant's last known address: Street, city state, zip code**

2. **Personally**

3. **By leaving a copy at the defendant's usual place of business with _____ (name) and relationship _____ a person of discretion working therein who was informed of the contents thereof.**

For methods 2 and 3, make sure to secure a signature.

I HAVE RECEIVED A COPY OF THESE ORDERS

Signature of Recipient_____ Other ID_____
Address_____ DOB_____
Phone_____ Race_____ Height_____ Weight___ Hair_____ Eyes_____
Sex_____

Examples of Placards

THIS BUILDING CANNOT BE USED FOR HUMAN HABITATION, OCCUPANCY OR USE

Pursuant to Secs. I of the Human Health Hazard Ordinance #01-08-02, the Buffalo County Health Officer has determined this property to be a human health hazard and unfit for human habitation, occupancy or use and has issued an Order for Abatement under Sec. I of said ordinance. Until the human health hazard is abated, any person using this property for human habitation, occupancy or use is subject to penalties, including a forfeiture not less than $200.00 nor more than $500.00 for each violation. For more information contact the Buffalo County Health Officer, Department of Health and Human Services, Buffalo County Courthouse, 407 S. 2nd St., Alma, WI 54610, (608)685-4412.

Name of Property Owner: Audrey Passe

Description of Property: 238 \
Lot 2

Department of Health and Human Services

Dated: August 13, 2009

by: _____

S:\Corp Counsel\Passe.Placard.blg.wpd

Examples of Placards (continued)

WARNING:
LEAD HAZARD

This dwelling contains Lead Hazards that pose a risk of poisoning, especially for young children and women who are pregnant.

Date Posted:_____

NO PERSON SHALL DEFACE OR REMOVE THE PLACARD FROM ANY DWELLING OR DWELLING UNIT.

LA CROSSE COUNTY HEALTH DEPARTMENT • 785-9771

Examples of Placards (continued)