



Environmental Health Division
PO Box 64975
St. Paul, MN 55164-0975
651-201-4620
www.health.state.mn.us/lead

Lead Poisoning Prevention Programs Biennial Report

Minnesota Department of Health
Report to the Minnesota Legislature 2015

February 2015

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**For more information, contact:
Environmental Health Division
Minnesota Department of Health
P.O. Box 64975
St. Paul, MN 55164-0975**

**Phone: 651-201-4620
Fax: 651-201-4909**

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Definitions

ABLES	Adult Blood Lead Epidemiology and Surveillance
ALC	MDH Asbestos and Lead Compliance Unit
BLIS	Blood Lead Information System
CDC	US Centers for Disease Control and Prevention
CLPPP	Childhood Lead Poisoning Prevention Program
DHS	Minnesota Department of Human Services
EBLL	Elevated blood lead level; 5 µg/dL under current Minnesota statutes
EPA	US Environmental Protection Agency
ESA	MDH Environmental Surveillance and Assessment Section
HUD	US Department of Housing and Urban Development
LHCG	HUD Lead Hazard Control Grant
LHR	Lead hazard reduction
MDH	Minnesota Department of Health
MHCP	Minnesota Health Care Plans
MN	Minnesota
MS	Minnesota Statutes
NIOSH	National Institutes of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
RFP	Request for Proposals
µg/dL	Micrograms of lead per deciliter of whole blood

Executive Summary

The State of Minnesota has consistently played a leading role in identifying and addressing public health issues related to lead exposure. This report documents activities conducted by the Minnesota Department of Health (MDH) between January 2013 and January 2015. As of the last legislative report in 2013, the lead program at MDH had reached a critical crossroads; federal funding cuts threatened to eliminate surveillance, medical case management, and most planning and education/outreach efforts. In 2015, a combination of state and federal funding sources has bolstered efforts to maintain a leadership role and protect the health and well-being of the citizens of Minnesota from the potentially devastating effects of exposure to lead and other housing-based health hazards.

Scientific evidence continues to demonstrate toxic effects of lead at low levels; recent literature shows there is no safe level of exposure to lead. This prompted the Commissioner of Health to lower the threshold for an elevated blood lead level (EBLL) in April 2014.

MDH continued to collect information on all lead tests performed on Minnesota residents through the Blood Lead Information System (BLIS). During 2013 and 2014 the number of blood lead tests performed remained at a high level. The number of EBLL cases continued to decrease, which is consistent with national trends. When children are identified, MDH provides case management support to local public health agencies.

MDH lead program compliance staff have continued their efforts in compliance assistance, compliance monitoring and enforcement activities. This is accomplished by promoting education and compliance training, licensing, and registering lead professionals and certifying firms performing regulated lead work, approving training courses, and conducting compliance monitoring and enforcement activities.

The lead program is responsible for educating and communicating effectively about health risks of lead. These activities are focused in areas of the state where cities of the first class (cities with at least 100,000 inhabitants) have not assumed responsibility for lead inspection and hazard reduction.

Although reported EBLLs are declining nationally and in Minnesota, the state needs to continue to effectively reach the remaining at-risk populations. High-risk populations tend to be diverse, under-served, highly mobile, and often face barriers that impede effective communication. Lead programs nationally are transitioning to include “healthy homes” education and home assessments. The 2014 Minnesota legislature passed Minnesota Statutes 144.9513, which established Healthy Housing Grants. These grants were awarded in October 2014 and grant activities have begun.

Future activities will focus on maintaining current program capacity and assuring effective use of available funds. These activities will include:

- Continuing examination of trends in lead poisoning in Minnesota children;
- Continuing to offer outreach and education to contractors working on residential projects; educate them about the hazards associated with working with lead based paint and recent developments in federal rules and regulations;
- Continuing to implement healthy homes grants and expand capacity for addressing housing-based health threats;
- Working with external partners to promote awareness of lead and ensure appropriate delivery of services to at-risk children;
- Continuing efforts to maintain the high quality of data in the surveillance database;
- Continuing to evaluate compliance monitoring and enforcement efforts to ensure that a properly trained and skilled lead workforce exists in Minnesota; and
- Continuing to provide compliance assistance and presentations to the public and the regulated community

Introduction

This biennial report addressing state lead poisoning prevention activities is required by Minnesota Statutes, section 144.9509, subdivision 3, which states:

The commissioner shall examine compliance with Minnesota's existing lead standards and rules and report to the legislature biennially, beginning February 15, 1997, including an evaluation of current lead program activities by the state and boards of health, the need for any additional enforcement procedures, recommendations on developing a method to enforce compliance with lead standards, and cost estimates of any proposed enforcement procedure. The report shall also include a geographic analysis of all blood lead assays showing incidence data and environmental analyses reported or collected by the commissioner.

Due to the time lag involved in collecting, analyzing, and reporting data, numbers are presented through the end of 2013. This report cost \$3,000 to prepare, including staff time, printing, and distribution costs. Information used to compile this report was obtained from MDH files, including both public and private data sources. The complete 2015 legislative report may be found on the MDH website at: www.health.state.mn.us/divs/eh/lead, and is available upon request.

Controlling exposures to lead is critical to protecting the health of Minnesotans. Exposure to lead can cause learning difficulties, reduction in IQ, and behavior problems in children. Lead exposure has also been associated with infertility, miscarriages, and increased risk of stroke, heart disease, and kidney disease in adults. Children under the age of six and pregnant women are most at risk for harmful impacts of lead. Deteriorated lead paint in homes remains the primary source of lead exposure, but many other sources of lead have been found, such as contaminated soil, some

imported products and traditional remedies, and occupational sources.

Elevated Blood Lead Levels

The Centers for Disease Control and Prevention (CDC) no longer supports the previous terminology of a “level of concern” because it implies that there is some safe level of lead exposure; CDC now acknowledges that there is no safe level of exposure to lead, and the effects of lead exposure appear to be irreversible in the absence of any other interventions. As a result, CDC recently adopted a reference value of 5 micrograms of lead per deciliter of whole blood ($\mu\text{g}/\text{dL}$) as the threshold for triggering a public health response. This value is based on the average blood lead level in the American population. Because there is no safe level of exposure to lead, primary prevention, or preventing lead poisoning before it can start, is crucial.

Minnesota statute 144.9504 mandates environmental interventions for confirmed blood lead levels of 15 $\mu\text{g}/\text{dL}$ or greater in children less than six years old. For levels of 5 $\mu\text{g}/\text{dL}$ or greater, existing state case management guidelines recommended that local public health nurses work with families to decrease lead levels. For most children and adults with lead poisoning, identification and elimination of the source of lead is the main treatment.

In April 2014, Health Commissioner Dr. Edward Ehlinger issued a finding that changed the definition of an EBLL under Minnesota statute 144.9501 Subd. 9 to a diagnostic blood lead test of at least 5 $\mu\text{g}/\text{dL}$ (**Appendix A**). The previous definition of an EBLL had been 10 $\mu\text{g}/\text{dL}$. The commissioner's finding makes the statute consistent with the existing Minnesota case management guidelines, established scientific literature, and CDC recommendations.

Current State Lead Programs

Lead poisoning prevention activities at MDH continue to be housed within the Division of Environmental Health. The Environmental Impacts Analysis Unit, in the Environmental Surveillance and Assessment (ESA) Section, is responsible for lead-related surveillance activities and case management. The Asbestos & Lead Compliance (ALC) Unit, in the Indoor Environments and Radiation Section, is responsible for assuring compliance with state rules and statutes dealing with lead hazards. Other state agencies dealing with lead or blood lead testing include the Pollution Control Agency, Department of Agriculture, Occupational Safety and Health Administration, Department of Natural Resources, Housing Finance Agency, Department of Human Services, and Department of Employment and Economic Development. Cities of the first class and counties, as well as MDH, also have duties with respect to environmental case management.

The ESA section manages the state-funded Swab Team Services Grants and Healthy Homes Grants. The ESA section managed the CDC Childhood Lead Poisoning Prevention Program (CLPPP) grant until 2012, when CDC discontinued funding for all state cooperative agreements. In 2014, CDC resumed funding for the CLPPP, and the MDH lead program successfully competed for these new funds. The ESA section also managed the Adult Blood Lead Epidemiology and Surveillance (ABLES) Program until the National Institutes of Occupational Safety and Health (NIOSH) discontinued ABLES funding in September 2013. The ALC Unit completed its Department of Housing and Urban Development (HUD) Lead Hazard Control Grant (LHCG) in November 2014.

MDH strives to provide the best possible service to Minnesota families whose children have possible lead-related health problems. MDH also provides needed information about lead issues to local public health officials, physicians, organized health care providers, and

other professionals responsible for preventing and managing lead risks in the most effective and efficient manner possible.

Funding from both state and federal sources allow MDH to operate the statewide database (which is used to evaluate programs, assess population trends, and target limited resources to areas of highest need), maintain guidelines for screening, case management and clinical practice, provide funding to local agencies for healthy homes assessments, and conduct strategic planning with an array of collaborative partners from government, health care, private industry, and non-profit organizations.

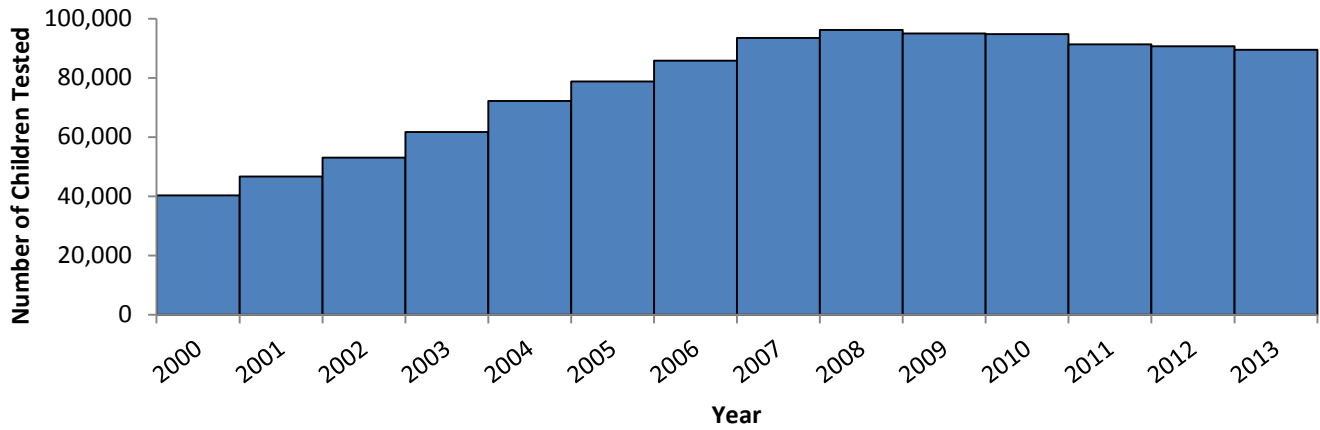
I. Surveillance Activities

MDH maintains a secure blood lead surveillance system for the purpose of monitoring trends in blood lead levels in adults and children in Minnesota. Whenever Minnesota residents are tested for blood lead, analyzing laboratories submit the results to the MDH lead program, as mandated by Minnesota Statutes, 144.9502. The results are entered either manually or electronically into the Blood Lead Information System (BLIS) database.

As of January 2015, the blood lead database contained over 1.7 million records of blood lead test results from 1.1 million individual Minnesota residents dating back to 1993.

Since not all Minnesota children have a high risk for lead exposure, targeted screening based on established risk factors is currently recommended for most areas of the state. However, because testing is not universal, the tests reported to BLIS are not representative of the entire population of Minnesota. A direct comparison of numbers of children with EBLLs between Minnesota counties is not appropriate because the counties have different rates of testing. However, the data may be used to identify trends in screening practices from year to year, compare the total number of EBLLs reported to MDH over time, and characterize the population currently being screened.

Figure 1. Number of Children Tested (Less than 6 Years of Age)



Presented below are data on lead poisoning in children less than six years old and adults, an overview of projects targeted to at-risk populations, and MDH statewide lead guidance. Further surveillance data are available in the 2013 Surveillance Report (**Appendix B**).

A. Elevated Blood Lead Levels (EBLLs) in Minnesota

Blood Lead Levels in Children

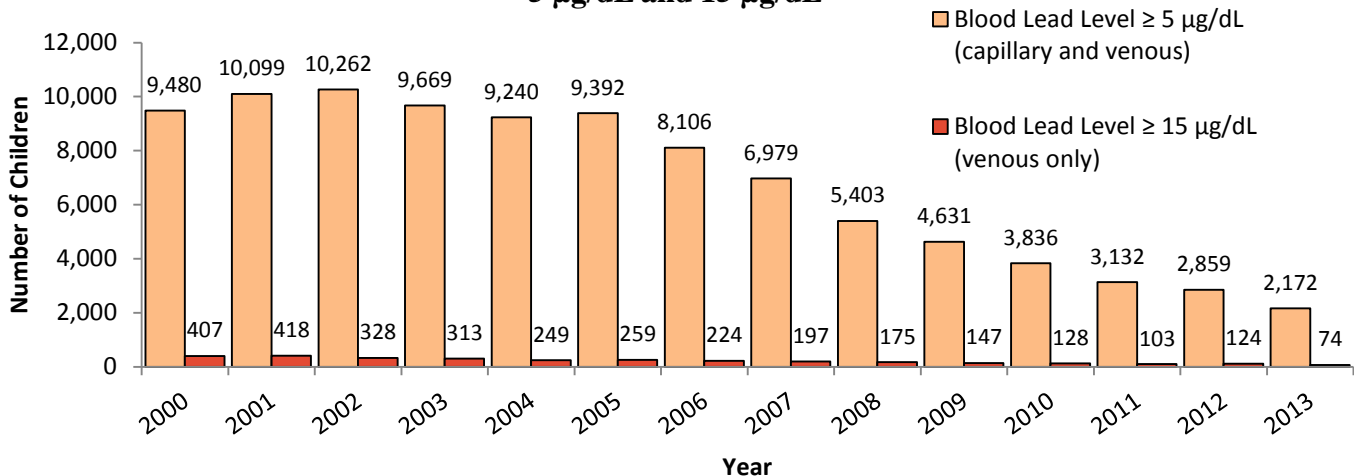
The number of children tested for lead in Minnesota increased from 2000 through 2008, then peaked and began to decrease during 2009–2013. Over 89,000 children were tested in 2013 (**Figure 1**). Since not all Minnesota children are at risk for lead exposure, targeted, rather than

universal testing is currently recommended for most areas of the state. Therefore, the optimal level of testing will be less than 100%. The goal is to test all children at risk for exposure to lead.

Trends in the number of EBLL cases (e.g., tests greater than or equal to 5 µg/dL) in Minnesota children may be compared across years (**Figure 2**). The general downward trend shown in Figure 2 is consistent with national trends. Numbers are also shown for venous blood lead levels greater than or equal to 15 µg/dL, the level at which an environmental assessment is required to identify and mitigate lead exposure.

While the rate of lead testing has remained high in the past decade, the number of EBLL cases has steadily declined. Although these data are difficult to interpret due to many confounding

Figure 2. Number of Children with Blood Lead Levels of at Least 5 µg/dL and 15 µg/dL



factors, the downward trend for EBLLs suggests that the amount of lead exposure is declining in Minnesota.

Rate of follow-up testing for children with EBLLs

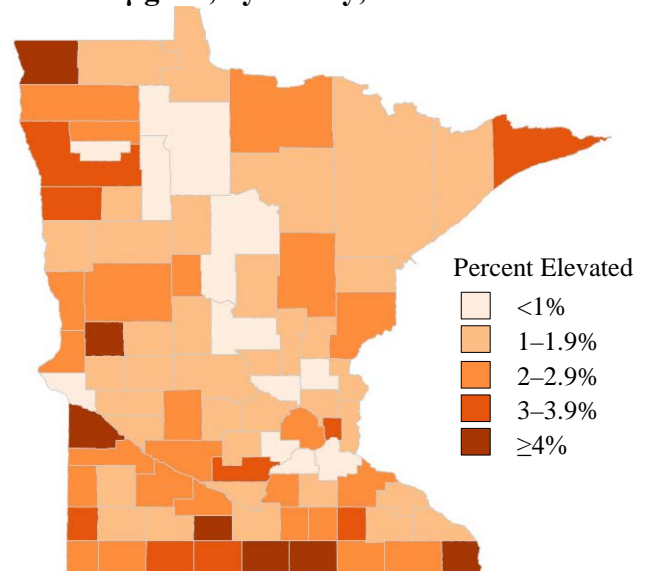
MDH guidelines recommend follow-up blood lead tests for children with elevated blood lead levels. The period of time recommended for retesting varies according to the initial blood level, but the maximum time is 90 days for any child with a blood lead level of 5 µg/dL or greater (an EBLL). Of the 2,172 Minnesota children identified with EBLLs in 2013, 1,546 (71%) received a follow-up test. Of these, 1,128 (52% of the children with EBLLs) were retested within 90 days of their initial test.

Follow-up testing has been recommended for blood lead tests of at least 5 µg/dL since 2011. Fewer follow-up tests were conducted in 2011 because the change in the guidelines occurred mid-year. However, in 2012 and 2013, follow-up rates steadily increased. Further increasing the follow-up rate and reducing the time between tests will take the combined efforts of providers, case managers, families, and the MDH Lead Program.

Geographic Distribution of Elevated Blood Lead Levels

Hennepin and Ramsey are the counties of residence for the largest numbers of children with EBLLs in Minnesota, representing over half of the children with EBLLs during 2012–2013. Universal screening of all one- and two-year olds is recommended for residents of Minneapolis and St. Paul. Therefore, Hennepin and Ramsey Counties have large numbers of children tested for lead, but do not have the highest percentages of EBLLs based on the number of children tested. The percentage of children tested for lead with an EBLL, by county, for 2012–2013 is shown in **Figure 3**. Screening tests for lead can be prone to falsely elevated results, so improved follow-up testing rates may decrease the apparent rate of EBLLs. Counties with high rates of EBLLs are distributed throughout the state.

Figure 3. Percentage of children less than 6 years of age tested for lead who had results of at least 5 µg/dL, by county, 2012–2013



Blood Lead Levels in Adults

Adults can also experience negative effects from exposure to lead; lead exposure is associated with increased blood pressure, stroke, kidney disease, and reproductive effects. Adult exposures are generally related to the workplace and can potentially impact both the individual and their family.

CDC has established a reference blood lead level of 10 µg/dL for adults and the Occupational Safety and Health Administration (OSHA) requires action in exposed workers with blood lead levels of at least 40 µg/dL. Minnesota's ABLES program began identifying eligible adults in 1998. Federal funding for the ABLES program ended in 2013.

In 2013, 8,975 blood lead test results were received from 7,849 adults. There were 493 adults with BLLs of 10–24 µg/dL, 99 adults with BLLs of 25–39 µg/dL, and 9 adults with reported levels of 40 µg/dL or greater. Data for 2014 are not yet available.

MDH is currently revising the *Blood Lead Screening Guidelines for Pregnant Women* which contain a screening questionnaire to

decide when to test a pregnant, or potentially pregnant, woman.

B. Studies and Projects in At-Risk Populations

Lead in Children Enrolled in Medicaid

Medicaid's Early and Periodic Screening Diagnosis and Treatment program requires that well-child visits include blood lead testing at both 12 and 24 months. National studies have shown that Medicaid-enrolled children are three times more likely to have elevated blood lead levels than non-enrolled children. These data were supported by studies done by the MDH Lead Program and Minnesota Department of Human Services (DHS). Children enrolled in Minnesota Health Care Programs (MHCP) were nearly twice as likely as non-MHCP children to have EBLLs. However, despite their high-risk status, less than a third of MHCP-enrolled children are tested by the time they reach 72 months.

In the past, DHS has implemented a 5% withhold on MHCP agreements with health plans to promote lead testing, especially for children in MHCP, which are a high-risk population across Minnesota. Unfortunately, the Minnesota DHS no longer provides monetary incentives to health plans to encourage blood lead testing. However, to help assess blood lead testing rates, MDH routinely matches BLIS data with information from DHS (using a data sharing agreement to ensure data privacy) and reports on test reports received. The matched data are important to ensure that reporting to federal agencies on mandatory testing is as accurate as possible.

Lead in Refugees

The Division of Infectious Disease Epidemiology, Prevention, and Control at MDH collects demographic data on all refugees entering the state who receive an initial health screening. A blood lead test is included in the standard schedule of medical checks for incoming refugees. In recent years, the majority

of refugees arriving in Minnesota have originated from East Africa and Southeast Asia.

Blood lead tests were matched to refugee information. During 2012–2013, over 15% of refugee children less than 17 years of age have had an elevated blood lead level of at least 5 µg/dL during their intake exam. The Lead Program will continue to monitor refugee blood lead levels to ensure EBLLs are identified and mitigated.

C. Screening and Case Management

MDH has developed and periodically updates a set of four guidelines for lead: Blood Lead Screening, Childhood Blood Lead Case Management, Childhood Blood Lead Clinical Treatment, and Blood Lead Screening for Pregnant Women. These guidelines were developed by collaborative workgroups and have been endorsed by a range of professional health organizations. All four guidelines may be found at the MDH Web site at <http://www.health.state.mn.us/divs/eh/lead/guidelines/index.html>.

MDH also provides technical assistance to all local public health agencies in Minnesota to ensure case management activities and follow-up testing for children and pregnant women are performed consistent with MDH guidelines.

The latest revision of the case management guidelines in 2011 included additional medical case management activities for test results between five and 10 µg/dL. This has dramatically increased the number of cases for MDH and local public health nurses across the state. Prior to the implementation of the new guidelines, at the end of state fiscal year 2011, there were 67 open cases requiring additional action. As January 2015, there were over 1,900 open cases. The increase in caseload for both state and local lead program staff emphasizes the need for continued state resources to support the program.

D. Environmental Case Management

Assessing agencies are required by MS 144.9504 to ensure that children with blood lead levels greater than or equal to 15 µg/dL are provided risk assessment services to limit exposure to lead hazards. Assessing agencies may also conduct lead risk assessments and issue lead hazard reduction (LHR) orders on a property for any child with an EBLL (≥ 5 µg/dL), as resources allow. MDH conducts risk assessments for children with blood lead levels of 5–14 µg/dL with extenuating circumstances or as resources permit.

A licensed lead risk assessor working under an assessing agency opens the environmental case on affected properties. A lead case manager and local public health professionals are also involved with education and follow-up with the affected family. An environmental case closure occurs when all LHR orders are completed and a clearance inspection demonstrates no deteriorated lead paint, bare soil, or lead dust exceeding standards (MS 144.9508) exist at the affected property or properties.

The basic steps in the environmental case management process include:

1. Conducting lead risk assessments at the affected property or properties;
2. Issuing LHR orders to the property owner; and
3. Conducting lead clearance testing after LHR is completed and is then verified by the assessing agency.

E. Economic Burden Report

The MDH Lead and Healthy Homes program contributed substantially to a report by the MDH Environmental Public Health Tracking Program: “The Economic Burden of the Environment on Two Childhood Diseases: Asthma & Lead Poisoning in Minnesota” (**Appendix C**). The report was released in December 2014 and found that despite decreases in the number of children exposed to lead, for the 2004 birth cohort, the total economic burden of childhood lead

poisoning in Minnesota on lifetime earnings is \$1.9 billion as a result of decreased IQ.

II. Compliance Activities

The 2013 American Community Survey estimates that Minnesota has over 2.3 million housing units, with over 520,000 of those units built before 1950. Homes built prior to 1950 are the most likely to contain the highest levels of leaded paint. The ALC Unit ensures the public receives safe and proper lead hazard reduction, evaluation, and analytical services by requiring those services to be conducted according to state regulations, and by trained and licensed personnel and certified firms. The ALC Unit was authorized by the U.S. Environmental Protection Agency (EPA) in September 1999 to administer and enforce the lead accreditation and compliance program in Minnesota. The Unit licenses lead risk assessors, lead inspectors, lead workers, lead supervisors, lead project designers, and certifies firms who conduct regulated lead work. In addition, the ALC Unit approves initial and refresher lead training courses for these disciplines, and registers lead sampling technicians.

The goal of regulation and enforcement in the MDH lead program is to limit lead exposure for children with EBLs and their families, and increase their understanding of lead-related health hazards by ensuring compliance with MDH lead poisoning prevention regulations. This regulatory role contributes to the core public health function of assurance: making physical environments safe and healthy.

A. Compliance Monitoring

MDH is the primary agency for lead hazard control and for regulating lead-related activities in Minnesota. MDH provides leadership on lead control program issues and works closely with federal, state, and local agencies, and other interested parties. Compliance monitoring involves efforts by the ALC Unit to monitor and evaluate individuals and companies as they perform regulated lead work.

A key objective of lead compliance is to make sure that potential environmental sources of lead exposure for persons with lead poisoning are properly addressed. The medical needs of the lead poisoned person are addressed through the collaborative efforts of surveillance staff, health care providers and case managers. Compliance monitoring involves efforts by the lead program to identify actual and potential environmental sources of lead exposure for persons with EBLLs. The ALC Unit is responsible for performing environmental interventions in areas not covered by another assessing agency.

Table 1 reflects the current number of lead licensed individuals as of January 2015. The table also includes the number of registered lead sampling technicians. These licenses are renewed annually if the individuals want to continue conducting regulated lead work.

Table 1. Total Number of Licenses Issued Across Minnesota — January 2015

Credential Issued	Total in MN
Certified Firm	286
Inspector	2
Project Designer	5
Risk Assessor	187
Supervisor	247
Worker	241
Lead Sampling Technicians	103

MDH is continuing its efforts in providing lead safe work practices information and brochures to licensed residential contractors in the state, including information at the department’s website:

<http://www.health.state.mn.us/divs/eh/lead>. EPA’s Renovate Right brochure was modified in September 2011 with new graphics and updated information. Residential contractors and other related construction trades are required to provide the new brochure in response to the EPA’s Renovate, Repair, and Paint regulation.

B. Training Courses

For an individual to be licensed in Minnesota, they must successfully complete a training course provided by an approved training course provider. Currently five providers offer Lead Hazard Reduction training in Minnesota, listed at:

www.health.state.mn.us/divs/eh/lead/training/index.cfm. Providers must furnish documentation that they employ a training manager and a principal instructor for each of the courses they offer. Both the training manager and principal instructor must meet experience, training and education requirements established in Minnesota Rules (4761.2000–4761.2700). Compliance staff regularly review training course content and ensure that student materials contain all the required topics.

C. MDH Compliance Inspections

MDH monitors firms and individuals performing regulated lead work. This is done by verifying that certified firms are employing MDH-licensed individuals to perform regulated lead work in affected property (e.g., single-family residences, multi-family properties, or child-occupied facilities). The monitoring includes both notices and inspections. Non-compliance is managed according to the Health Enforcement Consolidation Act (MS 144.989–144.993). MDH also provides compliance assistance to the regulated community through information on lead hazard reduction and compliance issues observed during inspections.

Table 2 reflects the number of lead abatement notices submitted to MDH, the number of inspections conducted by MDH and the number of project sites where enforcement actions were taken against certified lead firms and licensed individuals. Lead abatement notices are required when the “intent” of the work is lead abatement. MDH conducts inspections of lead abatement projects based on the notices submitted by certified lead firms. The numbers reflected in this table are based on the EPA’s fiscal cycle years 2013 and 2014. A federal fiscal cycle year runs from October to September.

The number of MDH inspections, audits, and reviews is based on benchmarks defined in a work plan submitted and approved by EPA Region Five on an annual basis. Formal audits include the review of risk assessment reports, inspection reports, clearance inspection reports, and lead hazard reduction reports.

Table 2. Number of Lead Hazard Reduction (LHR) Notices and Compliance Activities for Federal Fiscal Cycle 2013 and 2014

Item	2013	2014
Number of Lead Notices	393	376
Number of Training Course Permits	120	109
Number of LHR Inspections	48	53
Number of LHR Report Audits	44	32
Number of Training Course Audits	24	15
Number of Advisory Letters	10	8
Number of Enforcement Cases	23	6

III. Health Education and Outreach

The MDH Lead and Healthy Homes Program currently performs outreach and education activities for health care providers and the public through a variety of activities. A strong network has been forged through collaborative approaches to dealing with lead issues. Educational outreach has been conducted for numerous segments of professional and public groups through many types of meetings and presentations. Public awareness of lead issues is further raised through National/Statewide events such as Lead Poisoning Awareness Week and federal requirements for home sellers to disclose information about lead hazards.

A. Collaborative Workgroups

The development and implementation of effective lead poisoning prevention strategies

are collaborative activities. Success requires strong partnerships between public health agencies, health care providers, housing agencies, non-profit organizations, and individual citizens.

The Lead Compliance group annually convenes a group of contractors, trainers, risk assessors, and other professionals engaged with regulatory lead hazard reduction. Updates are provided on implementation of federal rules (e.g. EPA Renovation, Repair, and Painting), state policies, and best practices.

MDH was actively involved with the development and implementation of the Alliance for Healthy Homes and Communities (Alliance), a network of nonprofit organizations, and continues to support Alliance activities. Additional information is available at: <http://alliancehhc.org/>. The MDH Lead and Healthy Homes Program also participates in the Lead Testing Task Force. The Lead Testing Task Force is chaired by the Minneapolis Department of Health and Family Support and brings together public health, community health, and managed care organizations, to discuss and plan blood lead testing intervention strategies.

B. Outreach

The MDH Lead and Healthy Homes Program performs community outreach through the Swab Team Services Grants per Minnesota Statutes (MS) 144.9512. Current Swab Team Services Grant recipients do outreach and community engagement in both urban and rural areas. Populations targeted by the educational programs of current Swab Team Services Grant recipients include recent immigrants and refugees, families of seasonal agricultural workers, and the Southeast Asian community. The MDH Lead and Healthy Homes Program provides educational material in multiple languages to assist with this effort, including Spanish, Somali, Karin, and Hmong.

C. Internet Resources

The Lead Program maintains a web page through the MDH Internet site that provides a number of lead education materials for providers, regulated parties, and the general public: www.health.state.mn.us/divs/eh/lead. The site contains numerous fact sheets, a list of “frequently asked questions” and responses, publications and reports, a downloadable version of a lead education workshop, and links to external lead resources. MDH also maintains a healthy homes webpage, available at: <http://www.health.state.mn.us/divs/eh/homes/index.html>. Information is available on asbestos, asthma, carbon monoxide, drinking water, food safety, injury prevention, lead, mold/moisture, pest management, radon, ventilation, and volatile organic compounds.

Swab Team Services Grants

Swab Team Services grants are authorized under MS 144.9512. A request for proposals (RFP) from nonprofit organizations was issued during the summer of 2013. For October 1, 2013–June 30, 2015, \$796,337 in grant funds were available. Three applications were received, and all three were funded. The total amount of funds requested exceeded the funds available, so the applications were funded at reduced amounts. The grant recipients were CLEARCorps USA, Frogtown Neighborhood Association, and Sustainable Resources Center.

Swab team services are activities that provide protection from lead hazards primarily through the use of interim controls. Examples include thoroughly cleaning the residence using methods that do not further spread lead dust, removing loose paint, repainting, and covering or replacing bare soils. In addition to providing swab team services, the purpose of the Swab Team Services Grants is to:

- Increase lead screening among children under six years and pregnant women in populations at high risk for lead exposure
- Conduct lead screening events in communities with high lead exposure
- Provide education and outreach services regarding the home environment so that residents are protected from lead hazards

From October 2013–January 2015, over 1,000 children and pregnant women received blood lead testing through the Swab Team Services Grants. In addition, 20 educational events were conducted throughout the state. Culturally-appropriate home visits were made to 450 families, and swab team services were provided in 84 homes. Finally, training on how to safely control lead was provided to over 3,200 individuals.

Healthy Homes Grants

In 2014, the Minnesota Legislature passed 144.9513, which defined healthy housing and established healthy housing grants. In July 2014 MDH issued an RFP from local boards of health, community action agencies, and nonprofit organizations to participate in implementation grant agreements for healthy homes. The housing-based health threats to be addressed through these grants include:

- Lead
- Asthma
- Radon
- Injuries
- Smoking
- Excessive moisture/mold
- Pests
- Carbon monoxide
- Fire hazards
- Private wells

The scope of work in the RFP had a number of specific focus areas from which the grantees could choose, including:

1. Primary Prevention
2. Training and Technical Assistance
3. Developing Evidence-Based Best Practices
4. Community Engagement and Education
5. Healthy Home Assessments and Interventions
6. Coordination with Health Care/Secondary Prevention

A total of 14 applications were received for the eight available grants. Each grant agreement will last for three years, contingent on continued appropriations. Awards were divided into two funding levels. The larger awards are for \$40,000 annually and the smaller awards are for \$20,000 annually. One of the smaller awards is designated for mini grants. The organization administering the mini grant awards will administer five grants per year of approximately \$2,000 each. The goal of the mini grants is to promote health equity by funding smaller

organizations that would not have the capacity to apply for larger state grants. Successful applicants were distributed through metro and non-metro areas of the state, and are listed below and shown in the map (**Figure 4**).

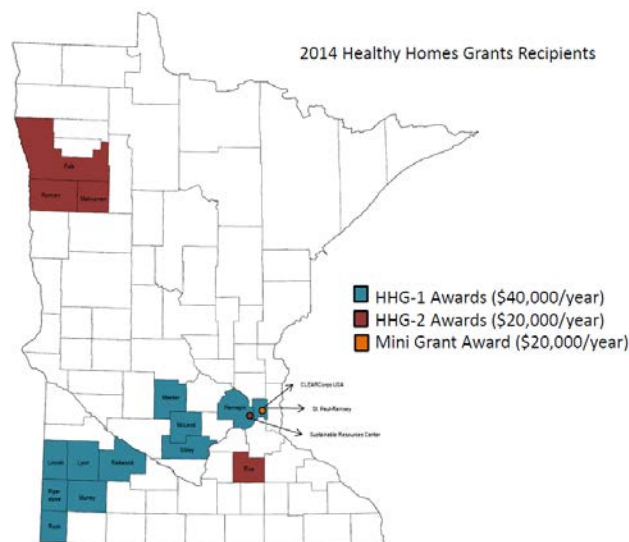
Awards of \$40,000 Per Year:

- Hennepin County
- Meeker-McLeod-Sibley Community Health Services
- Southwest Health and Human Services
- St. Paul-Ramsey County Public Health

Awards of \$20,000 Per Year:

- Polk-Norman-Mahnomen Community Health Board
- Rice County Community Health Services
- Sustainable Resources Center
- CLEARCorps USA (Mini Grant Award)

Figure 4. Grant recipients for the 2014 Healthy Homes Grants



Revised 9/23/2014

Legislative Activities

According to MS 144.9501, an EBLL is defined as a diagnostic blood lead test of at least 10 µg/dL in any person, unless the commissioner finds that a lower concentration is necessary to protect public health. On April 16, 2014, the Commissioner found that this definition was insufficient to protect public health. The new threshold for an EBLL is 5 µg/dL, which is consistent with the latest scientific literature and current MDH case management and clinical treatment guidelines. The new definition is also consistent with the current CDC “reference level” for lead. Decreasing the threshold for an EBLL gives MDH and lead assessing agencies additional regulatory authority to ensure that lead hazards are addressed.

The ALC Unit routinely assists in preparing responses to legislative inquiries on lead hazard reduction, intervention levels, and enforcement. This includes preparing fiscal notes, bill summaries, and required reports.

Lead program staff members are regularly called upon to provide data, background, and technical perspective on bills addressing lead poisoning and healthy homes.

Policy Planning and Program Evaluation

Data Quality Evaluation

Quality control procedures have reduced errors and increased completeness in the reporting of testing data. Missing information such as the patient's date of birth, address, and the type of test used are obtained for all reported tests when available from testing clinics and providers. The completeness of data and the timeliness with which it is reported and entered in the database are reviewed annually. Results of this review process are shared with the reporting laboratories, and MDH collaborates with the laboratories to continually improve the quality of their data.

Strategic Plans

MDH continues to implement both the Minnesota Childhood Lead Poisoning Elimination Plan, which was revised in 2011, and the Healthy Homes Strategic Plan, which was released in 2012. These plans guide the program as it builds program capacity, collaborates with internal and external partners, and plans for the future.

Healthy Homes

Recipients of the healthy homes grants were required to set performance measures. As the healthy homes grants continue to be implemented, the performance measures will be evaluated. The results of these evaluations will be included in future reports.

MDH will continue to work to transition a portion of lead program capacity to address multiple housing-based health threats in high risk populations.

Funding Status

State general funds are an important part of a larger public health effort to address lead poisoning in Minnesota. Overall program support sources are diverse but rely heavily on base state funding to help maintain capacity, both within MDH and with other partners in lead. The state's general fund allocates about \$300,000 annually to the MDH program. These funds are used to help meet MDH statutory obligations and are a critical source of matching funds for federal grant applications.

Assessment, assurance, and policy/planning are the three core functions of public health authorities. The environmental health trends identified by assessment (e.g., lead surveillance and compliance activities) will require a strong response with respect to assurance (e.g., compliance monitoring, case management) and policy/planning (e.g., primary prevention, provider/physician education). This will, in turn, require ongoing commitment from state general funds for these activities.

The bulk of funding for the MDH lead program has traditionally come from federal sources via grants and cooperative agreements. The lead program received funds of around \$500,000 annually for seventeen years from CDC to maintain a CLPPP program. In November 2012, CDC discontinued funding for all state cooperative agreements for the CLPPP. In 2014, CDC resumed funding for the CLPPP, and the MDH lead program successfully competed for these new funds, receiving a three-year grant of \$385,000 annually. However, NIOSH discontinued funding for the ABLES Program in September 2013.

MDH has received Lead Cooperative Agreement and Enforcement grants from EPA since 1994. The funding amount has averaged about \$245,000 for each of the past two years. This funding has provided ongoing development and support for the infrastructure of the ALC Unit. As the program has developed, the requirements of the grant have shifted from program development to compliance assistance, compliance monitoring and enforcement. EPA cannot guarantee that future funding will remain at current level but continues to work with all the Region V state lead programs to ensure that they are informed of funding changes.

The State Government Special Revenue Fund fee account was appropriated at \$57,000 for SFY 2014 (July 1, 2013–June 30, 2014). This revenue is generated from license, certification and permit fees. MDH does not charge a fee for the independent lead exams or to register lead sampling technicians. Currently MDH regulates 286 certified firms, 682 licensed individuals, 7 training organizations, and 103 registered individuals. A small number of lead professionals are employed by local government (e.g., assessing agencies) and are exempt from credentialing fees.

For October 1, 2013–June 20, 2015, MDH awarded a total of \$796,337 in Swab Team Services Grants to Sustainable Resources Center, CLEARCorps USA, and Frogtown Neighborhood Association. The grants are

authorized under Minnesota Statutes, section 144.9512, subdivision 2, to provide swab team services training to workers and property owners, and provide swab team services on affected properties. Grant funds may also be used to remove and replace building components that are identified by a licensed lead risk assessor as being a deteriorated component that also has deteriorated lead-based paint on it.

In 2014, a healthy housing grants program was established by Minnesota Statutes, section 144.9513. A total of \$300,000 annually was appropriated for the program; the MDH Lead and Healthy Homes Program receives \$60,000 of the appropriated funds to administer the program. Eight grants of \$20,000–40,000 have been awarded through this program for 2014–2017, and the recipients are distributed throughout the state.

MDH was awarded a 36-month HUD LHCG grant that will be completed in February 2015. The LHCG provided over \$1.7 million in funding for lead hazard control for 112 non-EBLL projects and 19 EBLL projects in non-entitlement areas of Minnesota. Other grants activities included providing contractor training for lead hazard remediation, practitioner's courses for healthy homes, and healthy homes assessments in each project.

As noted in the Economic Burden Report section (Section I.E.) of this report, the total economic burden of childhood lead poisoning in Minnesota on lifetime earnings for children born in 2004 is \$1.9 billion. Therefore, it is critical that state funding continue to support the program, help leverage federal support, and ensure that future generations are not burdened with the negative impacts of lead poisoning.

Future Directions

Future directions for the Minnesota Department of Health are largely determined by the requirements set by funding providers and the state legislature.

Lead program staff members will continue to actively improve the recording and transfer of lead test data. The blood lead database will require upgrades in the future to meet the technological needs of the program, and to increase flexibility as it expands to incorporate healthy homes data.

Education, outreach, compliance monitoring, and enforcement of lead paint regulations continue to be priorities for the state as part of federal grant funding provided by EPA. Lead compliance staff are actively involved in public education, outreach, compliance assistance and monitoring, and responding to public inquiries regarding general indoor air, lead and asbestos issues. Compliance and administrative staff have the necessary training and skills to implement compliance and enforcement activities.

Health education is performed by all staff within the lead program using established information sources and targeted outreach opportunities. As an interdisciplinary program, MDH lead staff will continue to generate unique and innovative approaches to institutional and scientific problems. Approaches will include forming cooperative workgroups to solicit input prior to generating guidelines, cooperating with other agencies to meet common goals, conducting research to address basic problems, and overseeing lead hazard reduction efforts to ensure complete and timely resolution of lead orders.

It will be a challenge to incorporate consistent healthy homes messages in the lead program and all of the diverse collaborating organizations. However, many agencies are very excited about the potential for increased capacity to address a range of housing-based health hazards and are looking forward to new ideas and approaches to promoting public health. The program will strive to remain flexible, responsive, and grounded in the core public health functions of assessment, assurance, and policy/planning.

Conclusions

Lead is a preventable environmental health risk. Although lead is found throughout the environment, the major exposure pathway of public health concern for children is through deteriorated lead-based paint.

The MDH blood lead surveillance database collects blood lead reports on all Minnesota residents. State guidelines help standardize screening practices and raise awareness of high-risk populations. The average blood lead level reported to MDH has been gradually declining, consistent with national trends. Diverse populations are targeted to help address public health disparities. While very high lead exposure levels have thankfully become relatively rare in the state, there are many high-risk areas where lead remains as a significant public health threat.

Compliance monitoring ensures that lead hazard reduction is completed in accordance with state regulations and best public health practices. This involves working with assessing agencies and the regulated community to address exposure issues in target housing and child-occupied facilities. Training is provided to homeowners and contractors, inspections are performed on lead hazard reduction projects, and risk assessments and lead inspections are audited as needed to ensure that public health concerns are addressed. Health education is performed by all staff within the lead program using well-established information sources and targeted outreach opportunities.

State funded transition of lead resources to healthy homes needs to continue in order to address housing-based health threats. Successfully implementing healthy homes will involve expanding program relationships to include additional housing and health organizations, an upgrade of data collection systems, and development of new policies

STATE OF MINNESOTA

COUNTY OF RAMSEY

**In Re: Definition of Elevated Blood Lead Level
Under Minnesota Statutes, Section 144.9501,
subdivision 9**

**FINDING OF THE
COMMISSIONER OF HEALTH**

FINDINGS

1. Exposure to lead has long been associated with IQ deficits, attention-related behaviors, and decreased academic achievement among children. Cardiovascular, immunological, and endocrine effects have also been reported.
2. Children less than six years old are most vulnerable to lead's toxicity due to their growing bodies, nutritional needs, normal mouthing behavior, and routinely spending time on the floor. Pregnant women and the developing fetus are also at risk because lead easily passes through the placenta to the fetus. Certain populations, including children enrolled in medical assistance programs, refugees, and immigrants, are at increased risk of lead poisoning.
3. There are many sources of lead, such as soil contaminated from years of leaded gasoline, lead dust accidentally brought home from parents' workplaces and hobby areas, and some imported products and traditional remedies. However, dust from deteriorated lead paint in homes is the main source of lead exposure for Minnesota children today.
4. The Minnesota Department of Health (MDH) collaborates with other agencies and groups to respond to elevated blood lead levels and support primary prevention of lead poisoning. These partnerships include local public health agencies, the medical community, and community organizations that receive Swab Team Services Grants, which are authorized under Minnesota Statutes, section 144.9512.
5. Minnesota Statutes, section 144.9501, subdivision 9, defines an "elevated blood lead level" as a diagnostic blood lead test with a result that is equal to or greater than ten micrograms of lead per deciliter of whole blood in any person, *unless the commissioner finds that a lower concentration is necessary to protect public health* [emphasis added].
6. Through a coordinated, multilateral public health effort, the number of children under six years of age with measured blood lead concentrations of at least ten micrograms per deciliter has decreased more than 80%, from 4,339 in 1995 to 527 in 2012. However, these numbers underestimate the thousands of Minnesota families that are still impacted by lead every year.
7. New scientific evidence has demonstrated adverse cognitive and physiological outcomes associated with blood lead concentrations less than ten micrograms per deciliter.

Appendix A

8. The Centers for Disease Control and Prevention (CDC) has acknowledged that no measureable level of blood lead is known to be without deleterious effects, and the effects of lead appear to be irreversible in the absence of any other interventions.
9. CDC currently recommends the use of a reference value for prioritizing the distribution of public health resources to respond to lead exposure, where a reference value is the 97.5th percentile of blood lead concentrations in the population.
10. Based on the National Health and Nutrition Examination Survey (NHANES), the current blood lead concentration reference value for children less than six years of age in the United States is five micrograms per deciliter.
11. MDH has a public health interest in preventing lead poisoning. Decreasing the threshold for blood lead concentrations that are considered elevated will give MDH and local public health agencies the authority to provide additional services to families that are affected by exposure to lead, but do not meet the current definition of an elevated blood lead level.
12. A change in the threshold for blood lead concentrations that are considered elevated will not alter Minnesota Statutes, section 144.9504, subdivision 2, which identifies the conditions under which an assessing agency shall conduct a lead risk assessment. Assessing agencies may still conduct lead risk assessments for children with any elevated blood lead level, within the limits of available local, state, and federal appropriations.
13. MDH guidelines for preventing childhood lead poisoning, which are assessed and updated regularly in collaboration with a range of partners to ensure consistency with recent scientific literature, indicate a number of steps for finding and responding to blood lead test results less than ten micrograms per deciliter.
14. The elimination of elevated blood lead in children is a goal at both the state and federal levels, through the State of Minnesota Childhood Lead Poisoning Elimination Plan and Healthy People 2020, respectively.

CONCLUSION

The threshold for an “elevated blood lead level”, as defined in Minnesota Statutes, section 144.9501, subdivision 9, of a diagnostic blood lead test with a result that is equal to or greater than ten micrograms of lead per deciliter of whole blood in any person is insufficient to protect public health and is not consistent with current best practices.

FINDING

I FIND THAT in order to protect public health, the definition of an “elevated blood lead level”, as defined in Minnesota Statutes, section 144.9501, subdivision 9, shall be modified to be a diagnostic blood lead test with a result that is equal to or greater than five micrograms of lead per deciliter of whole blood in any person.

Dated: 4/16, 2014
Saint Paul, Minnesota



Edward P. Ehlinger, M.D., M.S.P.H.
Commissioner of Health
State of Minnesota

REFERENCES

Information in this declaration is based on comprehensive reviews of the literature written by the CDC Agency for Toxic Substances and Disease Registry and CDC Advisory Committee on Childhood Lead Poisoning Prevention. State-specific information was derived from the MDH 2011–2012 Blood Lead Surveillance Report.

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2013 Blood Lead Surveillance Report



**Environmental Health Division
Environmental Surveillance and
Assessment Section
Environmental Impacts Analysis
Unit
Lead/Healthy Homes Program
P.O. Box 64975
St. Paul, Minnesota 55164-0975**

**For more information about lead, contact the
Lead/Healthy Homes Program at (651) 201-4620**

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(651) 201-5000 ♦ 1-888-345-0823 ♦ MDH TTY (651) 201-5797
www.health.state.mn.us/lead**

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Introduction

This 2013 Blood Lead Surveillance Report describes the activities of the Minnesota Department of Health (MDH) Lead Poisoning and Healthy Homes Program (LPHHP) and the data resulting from the MDH Blood Lead Information System (BLIS) for the 2013 calendar year.

The report contains a description of the trends in lead testing and elevated blood lead levels in Minnesota, and summarizes activities taking place in Minnesota to prevent childhood lead poisoning. The intent of this report is to provide information for stakeholders in Minnesota, document activities of the LPHHP, and assist local efforts to address housing-based health threats.

As the number of elevated blood lead cases in Minnesota has continued to steadily decline, the MDH LPHHP has also been incorporating “healthy homes” approaches into routine lead program activities.

Applying healthy homes strategies will help use existing lead poisoning prevention resources to address additional housing-based environmental health threats, including asthma, pests, fire safety, radon, carbon monoxide, and mold/moisture. This report contains an overview of steps taken to implement a healthy homes program in Minnesota.

The loss of federal funding continues to impact the program plans and activities of the LPHHP. MDH is discussing available options with other public health programs and collaborating partners to prioritize program functions and identify supporting resources.



Lead Poisoning

Although the toxicity of lead has been known for thousands of years, lead poisoning remains one of the most common environmental health threats to children. There are many sources of lead, such as soil contaminated from years of leaded gasoline, lead dust accidentally brought home from parents' workplaces and hobby areas, and some imported products and traditional remedies. However, deteriorated lead paint in homes is the main source of lead exposure for U.S. children today. Although lead paint was banned for residential use in 1978, many older homes still contain lead paint. It is estimated that nearly one million homes in Minnesota still have lead paint. These homes may be found in both urban and rural areas. As lead paint deteriorates, it creates fine dust that is identical in appearance to ordinary house dust.

Elevated levels of blood lead occurring during the first years of life may not produce symptoms until the children enter school and

display learning difficulties, reduction in IQ, or behavior problems.

Children less than six years old, and especially ages one to three years, are most vulnerable to lead's toxicity due to their growing bodies, nutritional needs, mouthing behavior, and spending time on the floor. Pregnant women and the developing fetus are also at risk because lead easily passes through the placenta to the fetus. The changing nutritional needs of the mother also cause release of lead stored in bone. Certain populations of children are at increased risk of lead poisoning. For example, children enrolled in medical assistance programs are more likely to live in older homes in poor condition, have poor nutrition, and live in urban areas that may contain lead-contaminated soils. Refugees and immigrants are also at increased risk because they are likely to have lead exposure in their home countries, may have poor nutritional status, and may live in substandard housing once in the U.S.



Elevated Blood Lead Levels

The Centers for Disease Control and Prevention (CDC) recently discarded their “level of concern” of 10 micrograms of lead per deciliter whole blood (µg/dL) in favor of a reference value of 5 µg/dL (**Figure 1**).

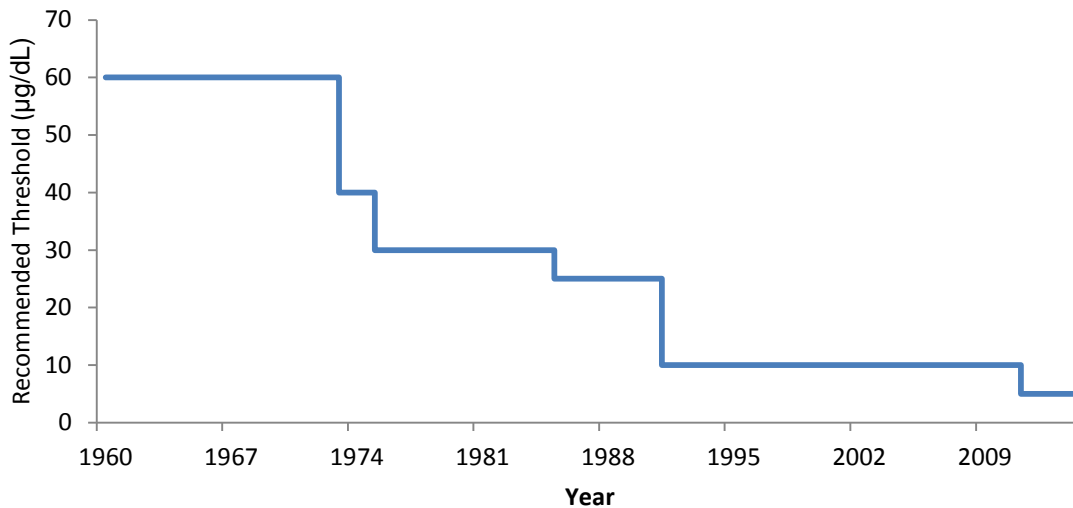
This value is based on the average blood lead level in the American population. Confirmed blood lead test results above the 5 µg/dL reference value are now expected to trigger a public health response. CDC also acknowledges that there is no safe level of exposure to lead, and the effects of lead exposure appear to be irreversible in the absence of any other interventions. Therefore, primary prevention, or preventing lead poisoning before it can start, is crucial.

Minnesota statute 144.9504 mandates environmental interventions for confirmed

blood lead levels of 15 µg/dL or greater in children less than six years old. For levels of 5 µg/dL or greater, local public health nurses work with families to bring down elevated lead levels. For most children and adults with lead poisoning, identification and elimination of the source of lead is the main treatment.

In April 2014, Health Commissioner Ed Ehlinger issued a finding that changed the definition of an elevated blood lead level (EBLL) under Minnesota statute 144.9501 Subd. 9 to a diagnostic blood lead test of at least 5 µg/dL. The previous definition of an EBLL had been 10 µg/dL. The commissioner’s finding makes the statute consistent with the existing Minnesota case management guidelines and CDC recommendations.

Figure 1. Historic CDC Recommendations for Elevated Blood Lead Level Thresholds



State Blood Lead Guidelines

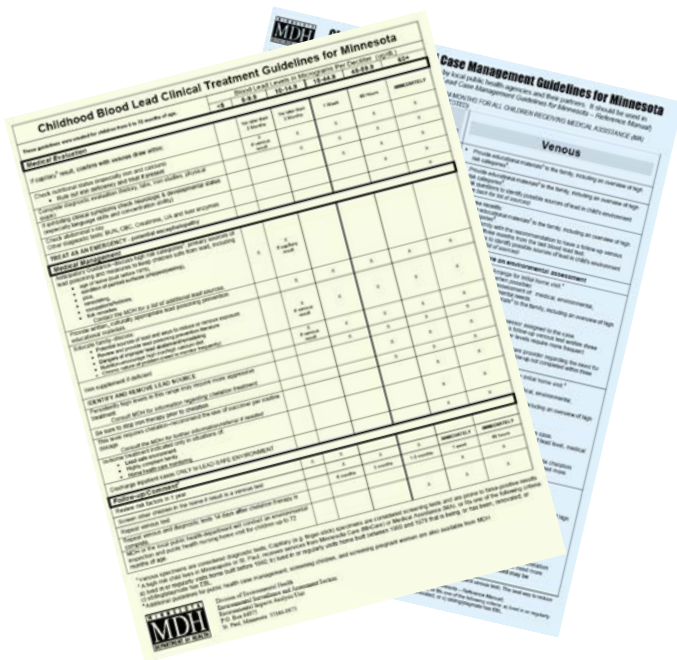
MDH has a set of four guidelines available for lead: Childhood Blood Lead Screening, Childhood Blood Lead Case Management, Childhood Blood Lead Clinical Treatment, and Blood Lead Screening for Pregnant Women, which may be found at the MDH Web site at www.health.state.mn.us/lead. These guidelines are intended to establish standardized screening practices and minimum levels of care for providing services to children. However, those local health departments that have greater resources available may wish to take a more rigorous approach to case management.

Childhood Blood Lead Screening Guidelines

The MDH Childhood Blood Lead Screening Guidelines direct physicians to order blood lead tests for 1) children residing in specific geographic areas that have high rates of elevated blood lead; and 2) children matching specific groups that have high rates of elevated blood lead. Universal screening is recommended for children residing in Minneapolis and St. Paul and those recently arriving from other major metropolitan areas or other countries. Screening is also recommended for children receiving Medicaid. The test is typically performed when the child is one and two years old, but may be done at any time if the parent is concerned or if a high-risk activity (e.g. remodeling a home built before 1950) has recently occurred.

Childhood Blood Lead Case Management Guidelines

The Case Management Guidelines work in concert with the MDH Blood Lead Screening Guidelines for Minnesota to identify and manage lead exposure in children. A qualified case manager should oversee the treatment and recovery of each child, and ensure that steps are taken to prevent further exposure of the child to potential sources of lead. Appropriate steps are presented for both capillary and venous test results.



Childhood Blood Lead Clinical Treatment Guidelines

The Childhood Blood Lead Clinical Treatment Guidelines are designed for physicians to assist them in treating patients in Minnesota with elevated blood lead levels, thus ensuring that all cases receive a consistent level of care. Because the CDC and MDH now recognize that there are no safe levels of exposure to lead, the clinical treatment guidelines recommend engaging families through education at blood lead levels of 5–10 µg/dL. Additional interventions are recommended for higher blood lead levels.

Blood Lead Screening Guidelines for Pregnant Women

The Blood Lead Screening Guidelines for Pregnant Women in Minnesota are designed to assist healthcare providers in screening pregnant women for elevated blood lead levels. Not every woman is at risk for lead exposure, so a risk screening questionnaire should be used to decide whether testing is recommended. Examples of risk factors for lead exposure include occupational exposure of the mother or another family member, remodeling a home containing lead paint, using non-commercial home remedies that contain lead, and pica behavior of the mother. Identifying and preventing elevated blood lead levels in pregnant women also serves to protect the developing fetus. The CDC and MDH consider 10 µg/dL and above to be an elevated blood lead level for pregnant women.

Case Management

The LPHHP provides technical assistance to local public health agencies in the state of Minnesota through the State Case Monitor position. Assistance is provided to ensure case management services are available for children with blood lead levels of at least 5 µg/dL. These activities include:

- Assuring case management activities and follow-up testing for children and pregnant women are performed in accordance with MDH guidelines;
- Providing educational materials, in appropriate languages, to assist in communicating lead exposure prevention measures;
- Communicating regularly with the Asbestos and Lead Compliance Unit to assess progress on open lead cases and facilitate communication between the Asbestos and Lead Compliance Unit and local lead case managers.

Case monitoring activities have helped clinicians improve their adherence to Minnesota Guideline procedures and have provided increased collaboration between public health and housing staff at both the state and local level.



Data Collection

Lead Testing

Since not all Minnesota children have a high risk for lead exposure, targeted screening based on established risk factors is currently recommended for most areas of the state. For children living within the city limits of Minneapolis or St. Paul, universal screening is currently recommended at one and two years of age, and up to six years of age for children who have not previously been screened. The goal is to test all children at risk for exposure to lead. Because lead testing is neither universal nor randomly sampled, the data in this report may not be representative of all Minnesota children.

The two main types of blood specimens used in blood lead testing are capillary and venous. Tests on capillary blood are considered “screening” tests because they are quick and inexpensive. Capillary blood specimens, which are drawn from a finger stick, tend to be more acceptable to parents and may be performed in a wider range of settings. However, a 2008 MDH study requested by the Legislature showed that 68% of initial elevated capillary results reported to MDH were false positives. Hand washing to reduce surface contamination with lead is a key step in preventing falsely elevated capillary samples.

Venous specimens are drawn from a vein and are considered “diagnostic” because they are less prone to false positives than capillary tests. However, they can be more difficult to obtain. Venous tests are required to initiate an environmental investigation of an elevated lead result. The full report on the 2008 MDH study of testing methods can be found at:

<http://www.health.state.mn.us/divs/eh/lead/reports/legislative07.pdf>.

The MN Blood Lead Information System (BLIS)

MDH maintains a blood lead information system (BLIS) for the purpose of monitoring trends in blood lead levels in adults and children in Minnesota. Analytical laboratories submit results to the LPHHP, as mandated by Minnesota Statute 144.9502. The data are used to help identify populations at risk for elevated blood lead levels (EBLLs), to help ensure that screening services are provided to groups identified as having the highest risk of lead poisoning, and to ensure that environmental and medical follow-up are provided to children with EBLLs.

The use of electronic reporting formats allows for greater efficiency in handling large numbers of records. The LPHHP works with the Minnesota Electronic Disease Surveillance System (MEDSS) to incorporate electronic reporting of blood lead test results in to routine data handling by MDH. Currently, approximately 80% of blood lead reports are received electronically, up from 27% in 1997.



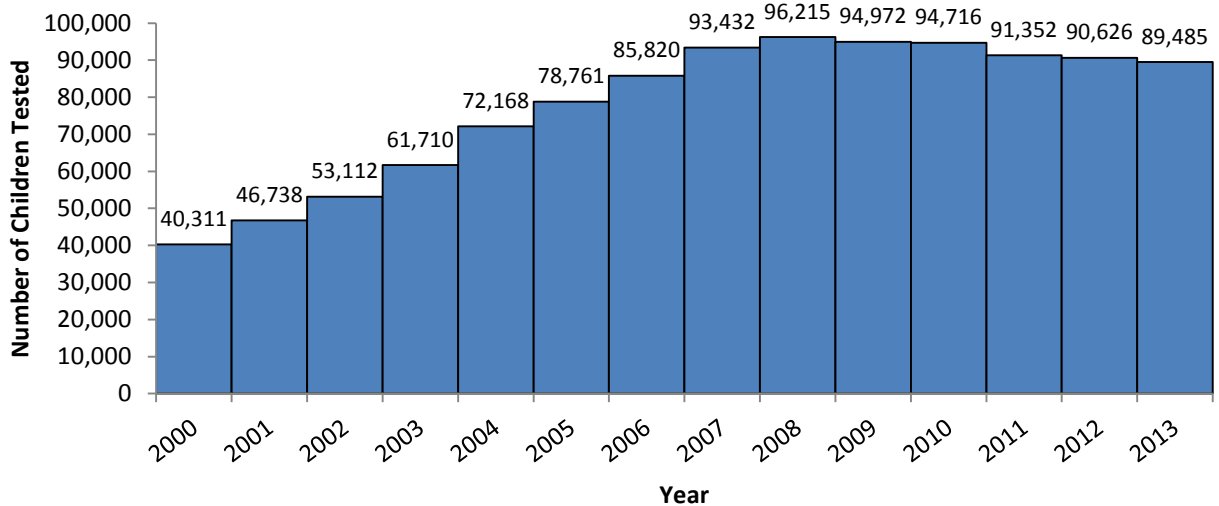
Statewide Surveillance Data

Statewide data are available starting from 1995. Data for years 2000–2012 are shown for comparison to the 2013 data. In 1995, fewer than 40,000 children were tested for lead and more than 4,300 children had blood lead levels of at least 10 µg/dL.

The number of children tested for lead in Minnesota increased from 2000 through 2008, then stabilized and began to decrease during 2009–2013. Over 89,000 children were tested in 2013 (**Figure 2**).

The decrease in the number of children tested for lead might be partially attributable to the loss of Medicaid withholds. Since 2013, Medicaid no longer withholds a portion of the reimbursement to clinics for well child visits unless a blood lead test is conducted. This has decreased the incentive for healthcare providers to ensure that all children receiving medical assistance are screened for lead at one and two years of age.

Figure 2. Number of Children Tested (Less than 6 Years of Age)

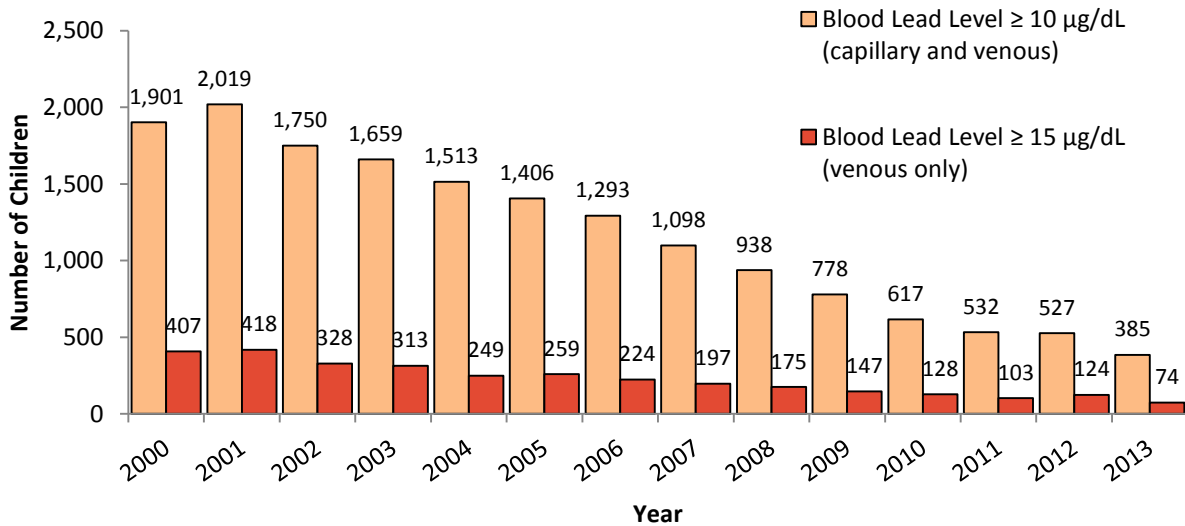


Blood Lead Levels in Children

The trends in the number of EBLL cases in Minnesota children may be compared across years (**Figure 3**). Thanks to ongoing prevention efforts, the number of EBLL cases has continued to decrease. However,

there were still 385 Minnesota children with at least one blood lead result of 10 µg/dL or greater in 2013. That includes 74 children who had venous blood lead levels of at least 15 µg/dL.

Figure 3. Number of Children with Blood Lead Levels of at Least 10 µg/dL and 15 µg/dL



Blood Lead Levels above Reference Range in Children

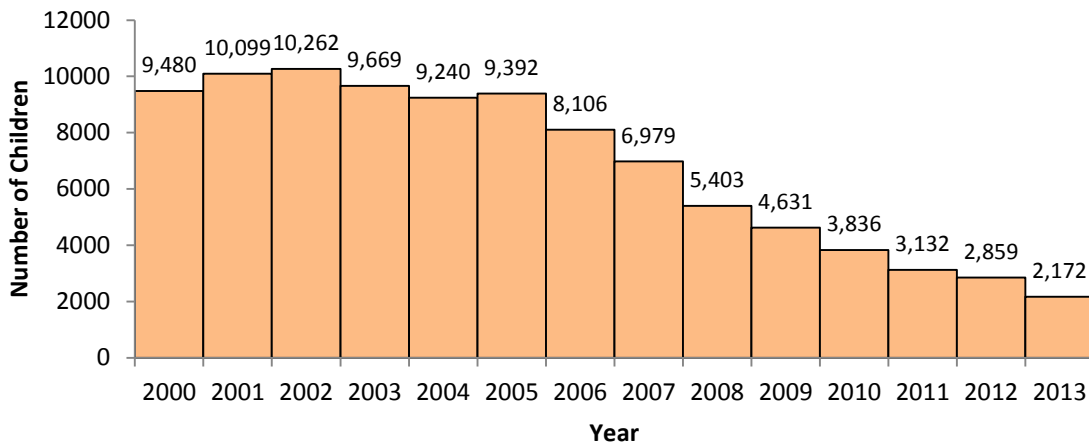
Starting in 2011, CDC discarded their “level of concern” in favor of a reference value of 5 µg/dL based on the average blood lead level in the American population. In April 2014, the definition of an elevated blood lead level in Minnesota was also changed to 5 µg/dL.

In 2013, there were 2,912 venous and capillary test results from 2,172 children of at least 5 µg/dL (**Figure 4**). Although the

new reference value was not implemented until 2011, data are shown for years 2000–2012 for comparison.

Children with blood lead levels in this range should receive follow-up testing and educational materials, according to the Minnesota case management guidelines. Rates of follow-up testing are described below. After attempts at follow-up testing were made, 1,589 children in 2013 still had blood lead levels of at least 5 µg/dL.

Figure 4. Number of Children with Blood Lead Levels of at Least 5 µg/dL



Blood Lead Testing by County

County-specific data on blood lead testing and blood lead levels are provided at the end of this report in **Appendix A**.

Follow-up Testing

MDH guidelines recommend follow-up blood lead tests for children with elevated blood lead levels. The period of time recommended for re-testing varies according to the initial blood level, but the maximum time is 90 days for any child with a blood lead level of 5 µg/dL or greater. Of the 2,172 Minnesota children identified with a

blood lead level of 5 µg/dL or greater in 2013, 1,546 (71%) received a follow-up test. Of these, 1,128 (52% of the children with blood lead levels of 5 µg/dL or greater) were retested within 90 days of their initial test.

Follow-up testing has been recommended for blood lead tests of at least 5 µg/dL since 2011. Fewer follow-up tests were conducted in 2011 because the change in the guidelines occurred mid-year. However, in 2012 and 2013, follow-up rates steadily increased. Further increasing the follow-up rate and reducing the time between tests will take the combined efforts of providers, case managers, families, and the MDH Lead Program.

Special populations

Medicaid Children

Medicaid's Early and Periodic Screening Diagnosis and Treatment (EPSDT) program requires that well-child visits include blood lead testing at both 12 and 24 months. National studies have shown that Medicaid-enrolled children are three times more likely to have elevated blood lead levels than non-enrolled children. These data were supported by a joint study between the MDH Lead Program and Minnesota Department of Human Services (DHS) released in 2002. Children enrolled in Minnesota Health Care Programs (MHCP) were nearly twice as likely as non-MHCP children to have

EBLLs (9.8% compared to 5%). However, despite their high-risk status, less than a third of MHCP-enrolled children are tested by the time they reach 72 months.

The Minnesota DHS no longer provides monetary incentives to health plans to encourage blood lead testing. However, to help assess blood lead testing rates, MDH routinely matches BLIS data with information from DHS (using a data sharing agreement to ensure data privacy) and reports on test reports received. The matched data are important to ensure that reporting to federal agencies on mandatory testing is as accurate as possible.

Refugee Children

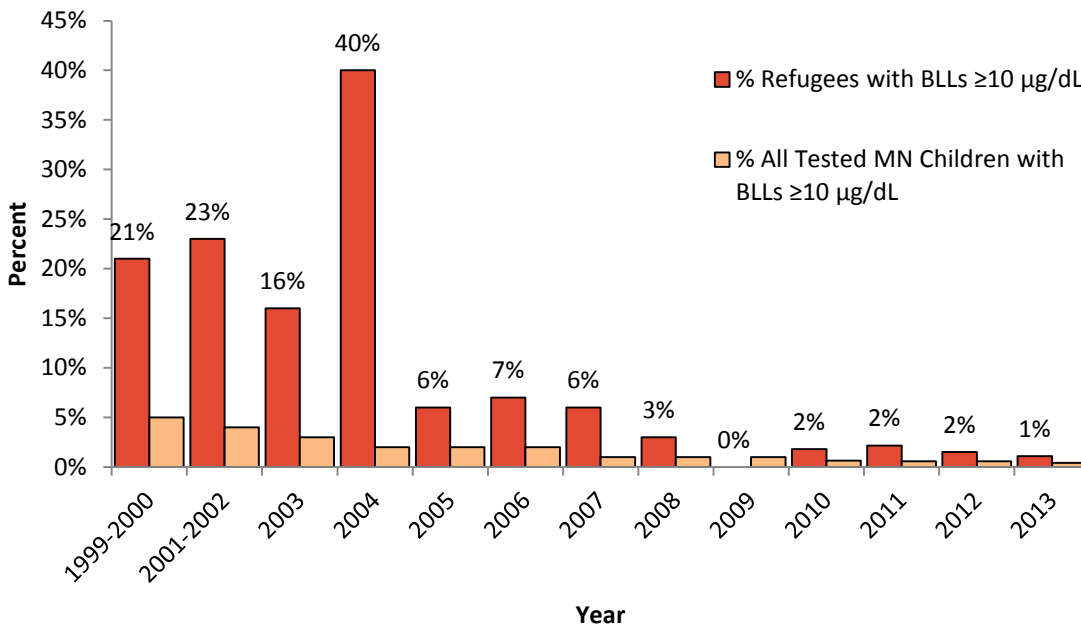
Refugees are persons who are forced to leave their home country because of disasters, war, or persecution, and come to Minnesota with a special immigration status. They are a population at high risk for lead poisoning. Refugees may have lead exposure in their countries of origin, and once they are in the U.S., refugees frequently move into older housing with potential for exposure to lead-based paint. The Division of Infectious Disease Epidemiology, Prevention, and Control at MDH collects demographic data on refugee

children aged less than 17 years entering the state who receive an initial health screening.

During the late 1990's, there were a substantial number of refugees arriving from Eastern Europe. Since that time, most refugees have originated from Sub-Saharan Africa and Southeast Asia.

Blood lead tests were matched to refugee information (**Figure 5**). Blood lead levels of at least 10 µg/dL have been identified among refugee children from multiple regions. The rate of elevated blood lead levels for refugees has been declining in the past several years.

Figure 5. Blood Lead Levels (BLLs) of at Least 10 µg/dL among Refugee Children Less than 17 Years of Age



Adults

CDC recommends a level of concern for adult exposure to lead of 25 µg/dL, while the Occupational Safety and Health Administration (OSHA) requires action in exposed workers at a level of 40 µg/dL. For pregnant adults, a blood lead level of 10 µg/dL or higher is considered elevated. Minnesota's Adult Blood Lead Epidemiology and Surveillance (ABLES) program began identifying adults with EBLLs in 1998.

The total number of tests reported in 2013 for adults in Minnesota is presented in **Table 1**. There were 99 adults with blood

lead levels of 25 to 39 µg/dL, and 9 adults with reported levels of 40 µg/dL or greater. Although pregnancy status is not a routine part of data collection, the LPHHP follows up on cases when notified that a patient with a blood lead level of at least 10 µg/dL is pregnant. Providers are urged to include a lead risk assessment questionnaire as a routine part of exams for pregnant women.

Federal funding for ABLES was discontinued during 2013. State resources will allow test results for adults to continue to be entered into BLIS, but the ability of the LPHHP to gather additional information on employers and occupations has been essentially eliminated.

Table 1. Minnesota Residents 16 years or Older with a Reported Blood Lead Level (BLL)

	2013
Number of Reports	8,975
Number of Individuals Tested	7,849
Individuals with BLL of 10–24 µg/dL	493
Individuals with BLL of 25–39 µg/dL	99
Individuals with BLL of ≥ 40 µg/dL	9
Range of Reported Results	0.0–66.3 µg/dL

Evaluation of BLIS

In 2013, there were 107,911 total blood lead tests reported to BLIS, 83% of which were received electronically (**Table 2**), which significantly improves timeliness and requires less staff time for entry of records into BLIS. The majority of tests received were capillary tests. Tests were received from 82 separate laboratories during 2013.

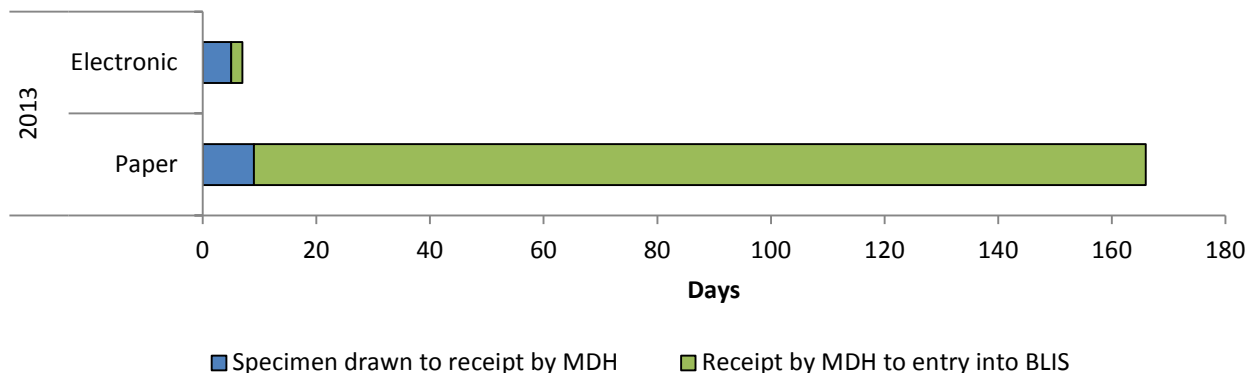
Extensive efforts are made by MDH staff to ensure the completeness of data in BLIS. During 2013, both city and zip code were missing only 2% of the time, (down from 9% in 2006). The patient’s date of birth was available for all records.

The median total time from specimen collection to entry into BLIS was 7 days for electronic records during 2013 (**Figure 6**). However, the loss of CDC funding led to a reduction in LPHHP staffing, causing an increase in the median time between specimen date and entry date for paper records from 35 days in 2011 to 166 days in 2013. State funding has been made available to recover some of this capacity, so the time required to enter records received by paper is expected to decrease. Support of the state’s capacity to enter all records in a timely manner remains critical to addressing the needs of children who have been exposed to lead.

Table 2. Number and Type of Blood Lead Test Results Reported to BLIS

	2013	
	No.	(%)
Blood lead tests reported	107,911	--
Paper reporting (<i>mail or fax</i>)	18,493	(17)
Electronic reporting (<i>encrypted email or secure web downloads</i>)	89,493	(83)
Blood test type		
Capillary	76,517	(71)
Venous	30,163	(28)
Unknown test type	1,231	(1)

Figure 6. Timing of Electronic and Paper Blood Lead Test Results Reported to BLIS, 2013



Other Resources Available from LPHHP

The Lead Program maintains a web page through the MDH Web site that provides a number of lead education materials for providers, regulated parties, and the general public (www.health.state.mn.us/lead). This site contains information on hot topics (including current data, projects and requirements), numerous fact sheets, a list of “frequently asked questions”, all publications and reports (including guidelines for screening children and pregnant women, case management, and clinical treatment in children), and links to many external lead resources.



Swab Team Services Grants

MDH has collaborated with community partners through Swab Team Services Grants since 2006. The grants are authorized under Minnesota Statute 144.9512.

MDH’s Swab Team Services Grant provides nonprofit organizations with funding to:

- Increase the screening of children under six years and pregnant women to determine elevated blood lead levels (EBLL) in populations at high risk, for lead exposure,
- Plan, implement, and execute successful lead screening events in communities with high lead exposure,
- Provide education and outreach services when an EBLL is identified, and
- Provide swab team services to protect populations from identified lead hazards in their residences.

Further Lead Information

More information about lead poisoning prevention in Minnesota is available at the MDH Lead Program web site:

www.health.state.mn.us/lead or by calling 651-201-4620.

Transition to Healthy Homes

Housing-related health and safety hazards have been identified through an in-home survey in 1,189 Twin Cities area homes. These homes are similar in demographic and building characteristics to homes receiving lead hazard reduction. The top five hazards observed or reported include 1) home not tested for radon (93%), 2) chipping or peeling paint (57%), 3) no CO alarm (43%), 4) mold/moisture issues (38%), and 5) fall hazards (18%).

Minnesota data compiled by MDH show that these housing-based hazards can have a significant impact on health and wellness:

- One in three Minnesota homes has high levels of radon and there is no area of the state that has a “low” radon exposure potential. Radon exposure increases the risk for lung cancer of Minnesota residents.
- Over 100,000 unintentional falls statewide were reported to the Minnesota Injury Data Access System in 2012; CDC estimates that about half of falls reported each year occur in the home.
- There were over 20,000 emergency department visits for asthma in 2011; over 8,000 of those visits were among children aged less than 15 years.
- From 2006 through 2010, 60 Minnesotans died from unintentional exposure to carbon monoxide (CO). The majority of these deaths occurred in the home.

The anticipated transition of the Lead Program to a healthy homes approach was significantly impacted by the loss of CDC funding effective September 1, 2012. Funding for Healthy Homes was provided by the Minnesota Legislature during the 2014 legislative session with the passage of Minnesota Statute 144.9513. Updates to the implementation of healthy homes grants using these funds will be provided in the 2014 Blood Lead Surveillance Report.



Healthy Housing Strategic Plan

In 2011, MDH engaged the Sustainable Resources Center (SRC), along with their partner the National Center for Healthy Homes (NCHH), for assistance in preparing a strategic plan for healthy housing in Minnesota, known as the Healthy Homes Strategic Plan (HH Plan).

The HH Plan was drafted through the participation of community partners, the HH Plan Steering Committee, and feedback from a statewide kick-off meeting and seven regional meetings.

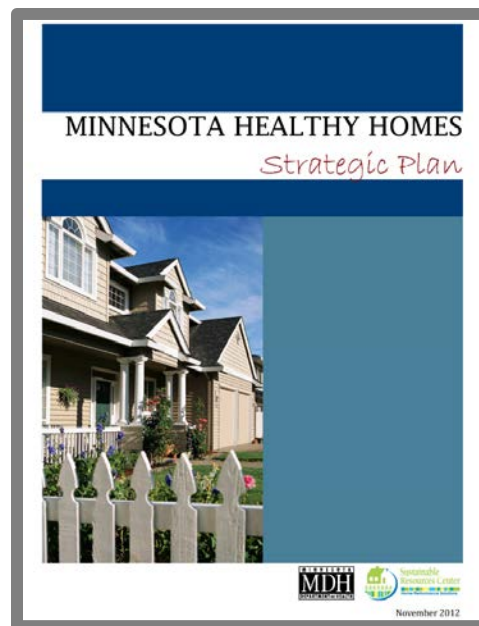
The HH Plan will be used to organize and evaluate program goals and timelines. It was approved at a statewide meeting in 2012. The vision elements of the HH Plan include:

- Centralized and accessible information clearinghouse
- Increased public awareness and education
- Social connectedness
- Medical capacity and referral system
- Widespread and comprehensive healthy housing inspections
- Adoption of safe and healthy housing policies
- Resources and services
- Sustainable funding
- Health-centric leadership
- Evaluation infrastructure and documented outcomes

SRC, working with Minnesota Green Communities and other partners, also created an Alliance for Healthy Homes and Communities in Minnesota (Alliance). The Alliance acts as a source of information and collaboration and helps integrate efforts for healthy homes and communities. The HH Plan (the structure) and the Alliance (the people) are working together to provide a framework for goals/tasks and ensure statewide communication and consistency.

Program updates and the Healthy Homes Strategic Plan are available at the MDH Lead Program website:

www.health.state.mn.us/lead



Appendix A: Blood Lead Testing, Children Aged Less than 6 Years, by County, 2013



Appendix A: Blood Lead Testing, Children Aged Less than 6 Years, by County, 2013

County	5 to 9.9 µg/dL*		10 to 14.9 µg/dL*		15 µg/dL or greater*		Total Children Tested		
	Venous	Capillary	Venous	Capillary	Venous	Capillary	Any test type	Population (2010)†	Percent Tested
Aitkin	0	2	0	1	0	0	138	948	15%
Anoka	24	27	1	1	0	0	6,197	27,058	23%
Becker	3	3	0	0	0	1	584	2,665	22%
Beltrami	0	3	1	0	0	0	638	4,032	16%
Benton	2	8	0	0	0	0	950	3,408	28%
Big Stone	0	1	0	0	0	0	82	346	24%
Blue Earth	4	3	1	0	1	0	814	4,479	18%
Brown	2	2	0	2	2	0	421	1,863	23%
Carlton	0	7	0	0	1	1	642	2,657	24%
Carver	0	4	0	0	0	0	1,030	8,272	12%
Cass	0	0	0	0	0	0	464	2,103	22%
Chippewa	1	0	0	0	0	0	234	963	24%
Chisago	2	4	0	0	0	0	668	4,011	17%
Clay	1	6	0	1	0	0	795	4,805	17%
Clearwater	0	0	0	0	0	0	64	727	9%
Cook	1	1	0	0	0	0	53	251	21%
Cottonwood	2	0	1	0	0	0	117	864	14%
Crow Wing	1	7	1	1	1	0	910	4,870	19%
Dakota	28	22	4	3	4	2	6,877	33,710	20%
Dodge	3	3	0	1	0	0	230	1,831	13%
Douglas	0	7	0	0	0	0	434	2,641	16%
Faribault	5	0	1	1	2	0	167	989	17%
Fillmore	0	3	1	1	0	0	193	1,713	11%
Freeborn	10	7	2	0	2	1	421	2,311	18%

*When multiple results were available, the highest venous result was used to categorize the individual. If no venous results were available, the highest capillary result was used.

†Population data obtained from: US DHHS, CDC, NCHS, United States July 1st resident population by state, county, age, sex, bridged-race, and Hispanic origin. Compiled from bridged-race Vintage 2012 (2010-2012) postcensal population estimates. Accessed at CDC WONDER On-line Database: <http://wonder.cdc.gov/bridged-race-v2012.html> on Oct 28, 2013.

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Goodhue	9	3	1	0	2	0	559	3,519	16%
Grant	1	5	0	0	0	1	104	438	24%
Hennepin	251	155	39	13	19	4	21,711	91,263	24%
Houston	2	4	0	1	0	2	226	1,363	17%
Hubbard	0	4	0	0	0	0	195	1,501	13%
Isanti	2	1	0	0	0	0	621	3,226	19%
Itasca	3	4	0	0	0	0	777	3,035	26%
Jackson	0	1	0	0	1	0	128	735	17%
Kanabec	3	2	0	0	0	0	208	1,196	17%
Kandiyohi	8	5	2	1	0	0	823	3,448	24%
Kittson	0	2	0	2	0	0	28	275	10%
Koochiching	0	1	0	0	0	0	146	771	19%
Lac Qui Parle	2	1	2	0	0	0	100	460	22%
Lake	0	0	0	0	0	0	140	688	20%
Lake of the Woods	0	1	0	0	0	0	21	250	8%
Le Sueur	4	2	2	1	1	0	312	2,261	14%
Lincoln	0	0	0	0	1	0	66	459	14%
Lyon	3	8	1	0	0	0	694	2,190	32%
McLeod	2	6	0	0	1	0	531	2,958	18%
Mahnomen	0	2	0	0	0	0	99	564	18%
Marshall	0	1	0	1	0	0	49	669	7%
Martin	2	6	2	1	0	0	244	1,455	17%
Meeker	2	1	0	0	1	0	312	1,941	16%
Mille Lacs	4	4	0	0	0	0	426	2,256	19%

*When multiple results were available, the highest venous result was used to categorize the individual. If no venous results were available, the highest capillary result was used.

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Morrison	1	3	0	0	0	0	597	2,719	22%
Mower	7	2	1	0	1	0	478	3,398	14%
Murray	0	0	1	0	0	0	123	618	20%
Nicollet	2	5	0	0	1	0	409	2,587	16%
Nobles	4	4	1	0	0	0	560	1,973	28%
Norman	0	2	0	0	0	0	63	489	13%
Olmsted	9	3	1	0	0	2	1,341	12,966	10%
Otter Tail	5	3	1	0	0	0	462	3,920	12%
Pennington	0	0	0	0	0	0	86	1,148	7%
Pine	2	3	0	0	0	0	372	2,107	18%
Pipestone	2	3	0	0	1	0	124	798	16%
Polk	3	7	1	0	0	0	276	2,498	11%
Pope	1	3	0	0	0	1	175	768	23%
Ramsey	157	168	24	8	20	2	12,105	41,610	29%
Red Lake	0	0	0	0	0	0	23	352	7%
Redwood	3	1	0	0	0	0	254	1,288	20%
Renville	2	4	1	1	0	0	316	1,096	29%
Rice	15	9	1	0	2	0	1,148	4,904	23%
Rock	0	5	0	0	0	0	140	821	17%
Roseau	0	2	0	0	0	0	97	1,183	8%
St. Louis	13	27	1	2	4	4	3,091	13,084	24%
Scott	4	2	0	1	0	0	2,303	13,013	18%
Sherburne	2	6	0	0	0	0	1,531	8,321	18%
Sibley	2	3	0	0	0	0	225	1,280	18%

*When multiple results were available, the highest venous result was used to categorize the individual. If no venous results were available, the highest capillary result was used.

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Stearns	6	11	3	0	1	0	2,708	11,610	23%
Steele	2	7	0	0	2	0	643	3,193	20%
Stevens	1	2	0	0	1	0	153	713	21%
Swift	1	0	0	0	0	0	162	669	24%
Todd	0	4	0	0	0	0	425	2,009	21%
Traverse	0	1	0	0	0	0	38	212	18%
Wabasha	2	3	0	0	0	0	245	1,618	15%
Wadena	1	6	1	1	0	0	271	1,092	25%
Waseca	0	4	0	0	0	0	305	1,475	21%
Washington	8	25	1	0	1	1	3,209	18,971	17%
Watonwan	1	9	0	1	0	0	205	906	23%
Wilkin	0	1	1	0	0	0	110	457	24%
Winona	1	0	0	0	1	0	395	3,242	12%
Wright	8	9	5	0	0	0	2,058	12,863	16%
Yellow Medicine	1	1	0	1	0	0	180	788	23%
Unknown	0	0	0	0	0	0	436	N/A	N/A
Minnesota Totals	653	687	106	47	74	22	89,485	427,197	21%

*When multiple results were available, the highest venous result was used to categorize the individual. If no venous results were available, the highest capillary result was used.

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The Economic Burden of the Environment on Two Childhood Diseases: Asthma & Lead Poisoning in Minnesota

DECEMBER 2014

Economic Burden of the Environment
on Two Childhood Diseases in Minnesota

MINNESOTA DEPARTMENT OF HEALTH
MINNESOTA ENVIRONMENTAL PUBLIC HEALTH TRACKING

DECEMBER 2014

For more information, contact:
Minnesota Department of Health
Minnesota Environmental Public Health Tracking
PO Box 64882, St. Paul, MN 55164-0882

Phone: 651-201-5900
Toll Free: 1-800-205-4987

Email: health.tracking@state.mn.us

Appendix C



Introduction

Childhood diseases have substantial impacts on families and communities. Several reports published over the past decade have estimated the costs to individuals and to society due to chronic diseases and developmental disorders in children (U.S. Environmental Protection Agency, 2013; World Health Organization, 2006).

This report focuses on two important environmentally-related health conditions in Minnesota's children: asthma and blood lead poisoning. It documents the economic cost of both conditions in one year, 2010, from current surveillance data and estimates the fraction that is attributable to environmental causes. It focuses on environmental factors that are amenable to interventions.

To estimate the economic value of preventive actions, this report demonstrates a method for using quality environmental public health tracking (surveillance) data. Using this approach, policy decisions and resources can be directed towards actions that have a measurable impact both in reducing childhood disease and saving money.

The Minnesota Environmental Public Health Tracking Program (MN Tracking) was established in 2007 by the Minnesota Legislature (MN Statutes, sections 144.995-998) and, in 2009, joined 23 other states as part of the Centers for Disease Control and Prevention (CDC) National Tracking Network. For this report, MN Tracking collaborated with CDC and other states with tracking programs including California, Connecticut, Florida, New Hampshire, Oregon and Utah. The Tracking Network is committed to making quality public health data more accessible and useful to the public for informing and evaluating environmental public health actions and policies.

MN Tracking worked closely with the Minnesota Department of Health (MDH) Asthma Program and the MDH Lead and Healthy Homes Program on this report.

KEY FINDINGS

- The total economic burden of childhood asthma in Minnesota in 2010 attributable to the environment was \$31.6 million (in 2014\$) (range: \$10.5 million – 36.9 million)

- The total economic burden of childhood lead poisoning in Minnesota on lifetime earnings is \$1.9 billion (in 2014\$).

KEY LIMITATIONS

- The costs calculated in this report likely underestimate the true cost to Minnesota's economy of asthma episodes and lead poisoning in children that are attributable to environmental risk factors.

- The burden and cost of environmentally attributed disease in Minnesota's children is not shared equally across all communities of the state.

- The Environmentally Attributable Fraction (EAF) is an uncertain estimate.

Methodology Overview

This report adopts methods established in previously published works (Landrigan, Schechter, Lipton, Fahs, & Schwartz, 2002; Trasande & Liu, 2011) and updates these methods with current state data and information.

The formula

The formula for estimating the economic burden of environmentally-related disease relies on the components described below:

ECONOMIC BURDEN:
DISEASE COUNTS
X
COST PER CASE
X
ENVIRONMENTALLY ATTRIBUTABLE FRACTION (EAF)

Economic burden is estimated as the number of cases of disease in a defined population and specified time period, multiplied by the environmentally attributable fraction (EAF) and the estimated cost per disease case. The time period used in this report was the 2010 calendar year.

Counts of disease cases

The estimated number of children treated for asthma came from the CDC Chronic Disease Cost Calculator. MN Tracking staff worked closely with the MDH Asthma Program to obtain data on child asthma deaths.

MN Tracking staff worked closely with the MDH Lead and Healthy Homes Program to determine the average blood lead level in Minnesota children born in 2004 based on MN Blood Lead Information System data.

Estimating costs per disease case, direct and indirect

For asthma, cost estimates were derived from the CDC Chronic Disease Cost Calculator for direct medical care costs per case in 2010 including the costs of clinic visits, hospitalizations, emergency department visits, and medications. Indirect costs, including wages lost from a parent who cares for a child with asthma, were also derived from the calculator, while the cost of a premature death was derived from Max, Rice, Sung & Michel (2004).

For childhood lead poisoning, cost estimates were calculated using wages lost from the impact of a lower IQ on lifetime earning capacity, derived from market productivity estimates in Grosse, Kreuger & Mvundura (2009).

The environmentally attributable fraction (EAF)

The environmentally attributable fraction (EAF) is the estimated proportion of disease cases that are thought to be causally associated with environmental risks. Environmental risks for this report include modifiable physical and chemical factors in our home, work and community environments. The calculations in this report exclude naturally occurring risks, such as radon, and behavioral risk factors such as smoking and diet, and are limited to risk factors that could be quantified based on the available scientific evidence.

EAF estimates the fraction of the disease that would be avoided or eliminated if the environmental risk were removed or reduced to the lowest level possible. Published relative risk estimates from the epidemiological literature and the prevalence of the exposure in the population are used to calculate the EAF. This report uses the EAF estimates first published by Landrigan et al. (2002).

The Costs of Childhood Asthma

Asthma burden and trends in Minnesota

About one in 14 Minnesota children (under 18) currently have asthma, or about 90,000 children.

Many indicators of the burden of asthma in Minnesota have been improving over time. Asthma hospitalization rates continue to decline in the seven-county Twin Cities metropolitan area, particularly among children. However, rates of asthma-related emergency department (ED) visits have remained relatively stable since 2005, and after a dramatic decrease through 2006, statewide asthma mortality rates have been rising slowly.

DISPARITIES OBSERVED

Asthma prevalence in Minnesota is currently lower than the national average; however, there are significant disparities in prevalence by race/ethnicity.

According to data from the 2013 Minnesota Student Survey,

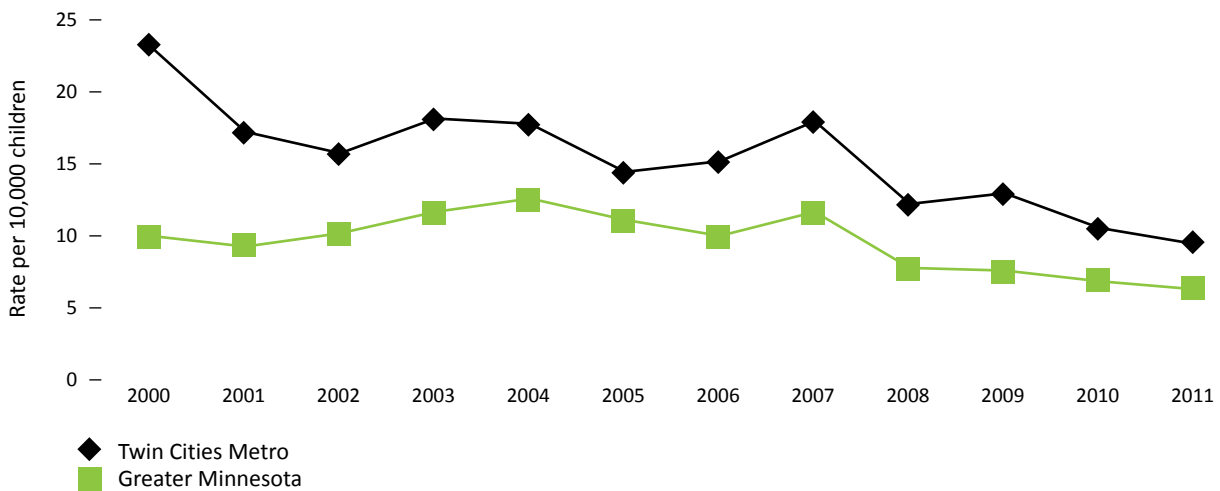
21% OF AMERICAN INDIAN AND 24% OF AFRICAN AMERICAN YOUTH REPORT AN ASTHMA DIAGNOSIS COMPARED TO 16% OF WHITE AND HISPANIC STUDENTS, AND 13% OF ASIAN STUDENTS.

According to 2012 data from the Behavioral Risk Factor Surveillance System,

ASTHMA PREVALENCE AMONG ADULTS IS HIGHER AMONG BLACKS (14%) THAN WHITES (8%).

Disparities in asthma prevalence by race/ethnicity are also evident among enrollees in Minnesota's medical assistance programs, with the highest prevalence among Blacks (Minnesota Department of Health, 2012).

ASTHMA HOSPITALIZATIONS FOR MINNESOTA CHILDREN



Source: Minnesota Hospital Association; MDH Asthma

Appendix C

There are striking geographic disparities in rates of asthma-related ED visits and hospitalizations in Minnesota. Asthma hospitalization rates among children living in the Twin Cities metropolitan area are 54% higher than among children living in Greater Minnesota. Rates of asthma-related ED visits are nearly twice as high among children in the Twin Cities metro area compared to children in Greater Minnesota.

RISK FACTORS

Most asthma episodes (also referred to as asthma exacerbations), including those resulting in hospitalizations, are preventable if asthma is properly managed according to established medical guidelines, which include reducing exposures to environmental triggers (National Asthma Education and Prevention Program, 2007). A variety of factors can trigger an asthma episode, including viral respiratory infections; exposure to allergens (e.g. dust mites, dander (protein particles shed by cats and dogs), and pollen; exercise; tobacco smoke; air pollution; strong emotions; chemical irritants; and drugs (e.g., aspirin and beta blockers).

Air pollution, such as particulate matter (PM), is associated with increased hospitalizations for asthma (Barnes, Rodger, & Thomson, 1998, p. 589-596; Trasande & Thurston, 2005).

In the Eastern U.S., summer ozone pollution is associated with more than 50,000 hospitalizations per year for asthma and other respiratory conditions. U.S. and Canadian studies have shown warm season ozone-associated increases in respiratory hospital admissions ranging from 2-30% per 20 ppb (24 hours), 30 ppb (8-hours) or 40 ppb (1-hour) (U.S. EPA, 2006).

EAF for asthma

Estimate: 30% (ranges from 10% to 35%)

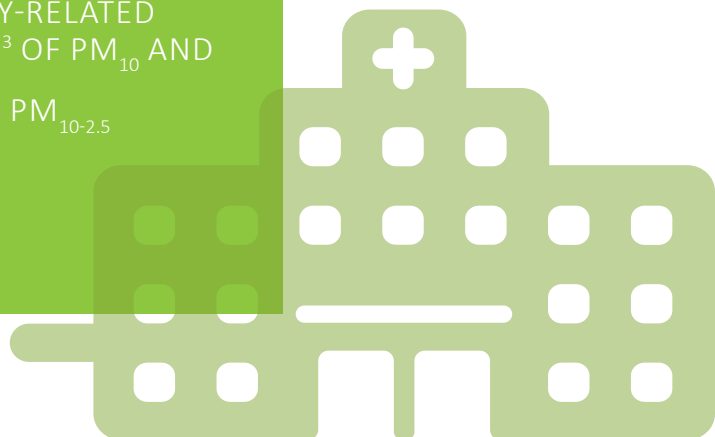
A panel of experts (Landrigan, et al., 2002) determined 30% of asthma episodes (exacerbations of childhood asthma) can be attributed to outdoor air pollution (e.g., vehicle exhaust and power plant emissions). This estimate does not include exacerbations due to other triggers such as mold, secondhand cigarette smoke, pollen, or respiratory infections.

STUDIES HAVE SHOWN

5-20% INCREASES IN RESPIRATORY-RELATED HOSPITALIZATIONS PER 50 $\mu\text{CG}/\text{M}^3$ OF PM_{10} AND

5-15% PER 25 $\mu\text{CG}/\text{M}^3$ OF $\text{PM}_{2.5}$ OR $\text{PM}_{10-2.5}$

WITH THE LARGEST EFFECT ON ASTHMA HOSPITALIZATIONS (U.S. EPA, 2004)



Appendix C

Economic Burden

The CDC Chronic Disease Cost Calculator (Centers for Disease Control and Prevention, 2013) estimates the number of asthma cases and then calculates the direct and indirect costs per case accrued over the course of one year for children ages 0-17 years, adjusted to 2014 dollars.

The number of childhood deaths in Minnesota due to asthma is quite small and can vary from year to year. Therefore, a five year average was used to calculate the annual average number of premature deaths; there were an average of 2 deaths due to asthma from 2007 to 2011 in Minnesota. Mortality cost for the premature death of a child was estimated using the present value of lifetime earnings (Max, et al., 2004). Values were averaged for both boys and girls for 0-17 years of age.

The following costs estimates are included in this report:

- Direct medical and non-medical costs
- Indirect costs, such as lost parental earnings due to school absenteeism
- Lost potential earnings due to premature death

The total costs of childhood asthma in Minnesota in 2010 was \$105 million (in 2014\$), including direct medical costs, indirect cost of missed school days, and deaths due to asthma. Applying the 30% EAF to this annual cost, **the total economic burden of childhood asthma in Minnesota in 2010 attributable to the environment was \$31.6 million (in 2014\$) (range: \$10.5 million – 36.9 million).**

TABLE 1: ANNUAL COSTS OF CHILDHOOD ASTHMA IN MINNESOTA IN 2010.

Type of cost	Included in cost	Inputs	Annual value (2014\$)
Direct (medical)	Physician visits, ED, hospitalizations, prescription medication	\$940 average cost x 78,900 children treated	\$80,190,000
Indirect (missed school)	Lost parental earnings due to missed school days	\$156 (daily wage) x 141,000 school days missed	\$23,840,000
Indirect (mortality)	On average, there were 2 premature deaths due to asthma (2007-2011 combined)	\$700,000 per premature death x 2 deaths (average)	\$1,400,000
Estimated total cost:			\$105,430,000
EAF:			30%
Environmentally attributable cost of childhood asthma:			\$31.6 million
Range (10%-35%):			(\$10.5- \$36.9 million)

Source: CDC Chronic Disease Cost Calculator; EAF = environmentally attributable fraction

Appendix C

The Costs of Childhood Blood Lead Poisoning

Disease burden in Minnesota

Lead poisoning is a medical condition that occurs when lead builds up in the body. Elevated blood lead levels (EBLLs) in young children are associated with adverse health effects, including learning impairment, behavioral problems, and even death at very high levels.

The proportion of children with lead poisoning has declined over time in Minnesota, from about 2% of children born in 2000 to less than 1% of children born in 2009, among children tested before 3 years of age.

THRESHOLD LOWERED

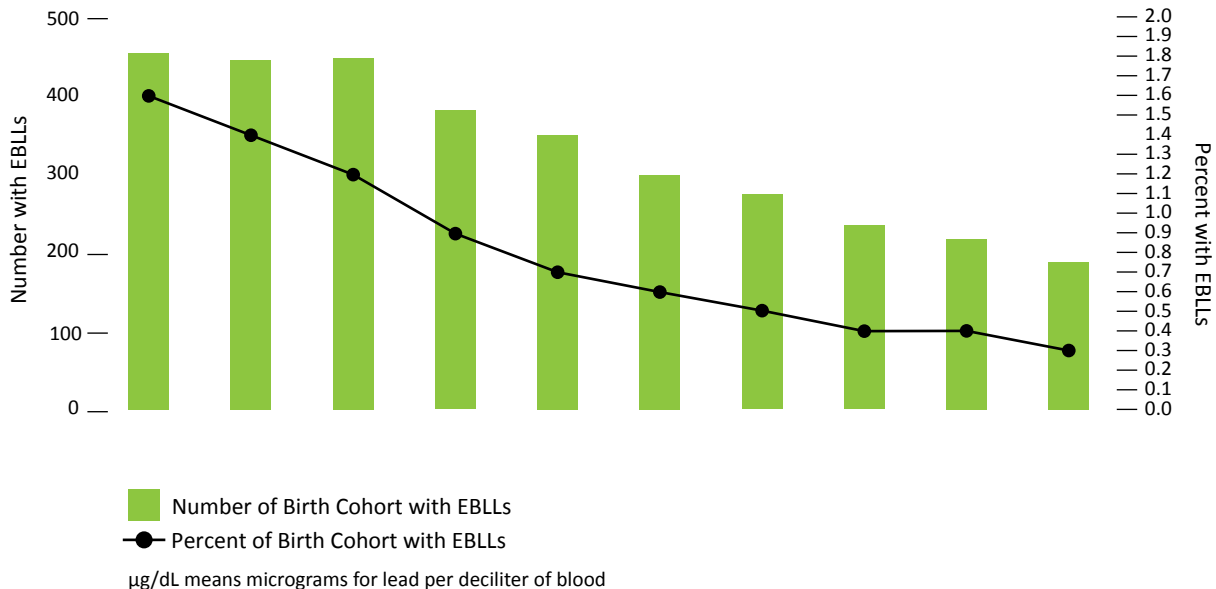
There is no safe level of exposure to lead. The threshold for an “elevated blood lead level” in Minnesota was recently lowered from 10 to 5 µg/dL (Minnesota Department of Health, 2014a). The CDC also recently lowered the threshold to 5 µg/dL, and future reductions are likely. This threshold is used to trigger actions for investigation and remediation of sources of lead in the home.

BLOOD LEAD LEVELS ARE DECLINING IN MINNESOTA

Testing for lead poisoning is important as it often occurs with no identifiable symptoms. The percentage of tested children with elevated blood lead, levels previously defined by the state of Minnesota as a level of 10 µg/dL or higher, has been decreasing.

Blood lead testing in Minnesota is targeted and not universal, meaning not every child is tested. That means this measure is not generalizable and cannot be used to interpret the prevalence or incidence for all children living in Minnesota.

CHILDREN WITH CONFIRMED ELEVATED BLOOD LEAD LEVELS (EBLLS) IN MN DISPAITIES OBSERVED (INCOME AND REGION)



Appendix C

DISPARITIES OBSERVED

Children in poverty are at greater risk for lead poisoning. About 15% of all children (<18 years) and about 17% of all children under age 5 in Minnesota live in poverty. The majority of counties in northern Minnesota have a higher percentage of children living in poverty, compared to the state average of 15%, as do Hennepin and Ramsey Counties.

RISK FACTORS

Children less than 6 years old living in homes built before 1978 are most at risk for lead poisoning. Younger children are more at risk because their bodies absorb lead more easily and their brains are still developing. Lead-based paint is a common cause of lead poisoning. People can be exposed to lead by ingesting dust from deteriorated lead paint, consuming other materials contaminated with lead, or breathing aerosolized lead paint dust. Young children frequently put their hands or other objects, which may be contaminated with lead, into their mouths. The U.S. EPA estimates that more than 80% of all homes built in the U.S. before 1978 contain lead-based paint.

EAF for childhood lead poisoning

EAF: 100% (no range)

A panel of experts (Landrigan et al., 2002) determined that all cases of lead poisoning are assumed to be of environmental origin. Therefore, the EAF is 100%, and no range was calculated.

Economic Burden

About 54,000 Minnesota children born in 2004 were tested before the age of 6, or about 76% of the 2004 birth cohort. The average peak blood lead level (BLL) was 2.5 micrograms of lead per deciliter of blood (µg/dL) – among children born in 2004 and tested up to age 6. This BLL was converted into lost IQ points, then into lost lifetime earnings for boys and girls, separately. **The total economic burden of childhood lead poisoning in Minnesota on lifetime earnings is \$1.9 billion (in 2014\$).**

TABLE 2: CALCULATION OF PERCENT LIFETIME EARNINGS LOST DUE TO CHILDHOOD LEAD POISONING AMONG THE 2004 BIRTH COHORT IN MINNESOTA.

Mean peak BLL	IQ points lost due to lead poisoning	Total IQ points lost due to lead poisoning	Lifetime earnings lost due to IQ points lost	Total lifetime earnings lost
2.5 µg/dL	0.47 IQ points per 1 µg/dL	1.19 IQ points	2.39% per IQ point lost	2.85%

TABLE 3: COST OF CHILDHOOD LEAD POISONING ATTRIBUTABLE TO THE ENVIRONMENT FOR THE 2004 BIRTH COHORT IN MINNESOTA.

Lifetime earnings lost due to lead poisoning		Lifetime earnings per child (2007\$)	Lifetime earnings lost per child	Number of children	Lifetime earnings lost	Final economic burden (2014\$)
2.85%	Boys	\$1,055,542	\$30,117	35,988	\$1,083,833,838	\$1.9 billion
	Girls	\$622,653	\$17,765	34,626	\$615,145,548	

Strategies to reduce environmental risks and improve children's health

Despite the limitations of the data (see page 14), this report points to important actions that Minnesotans can take to reduce exposure to environmental risks and lower the economic burden.

Actions Addressing Air Pollution and Asthma

According to a recent report, air quality in Minnesota has been steadily improving over the past 10 years (Minnesota Pollution Control Agency, 2013). Both ozone and particulate matter levels, which are known asthma triggers, are declining for most Minnesotans. Local initiatives, which include the Minnesota Emissions Reduction Project (reduced particle pollution from three metro area power plants), Project Green Fleet (reduced diesel emissions from school buses and other vehicles), and school bus anti-idling laws are examples of recent actions that are making a difference.

Soon, more stringent air quality standards will be adopted, and new initiatives will be needed, such as those proposed by Clean Air Minnesota (Environmental Initiative, 2014) for reducing wood smoke, retiring older, polluting vehicles, and incentives for alternative fuels. In 2014, the Minnesota Pollution Control Agency and MDH are working on developing new tools for urban communities for monitoring and addressing local sources of air pollution that exacerbate asthma.



The MDH Asthma Program educates health care providers, people with asthma, their caregivers, and others about ways to improve asthma care and reduce exposure to asthma triggers (Minnesota Department of Health, 2014b). Since 2005, the program has received funding for projects to conduct low-cost home environmental interventions. These projects have led to decreased asthma symptoms, fewer missed school days and health care visits following the intervention; the original project was included in CDC's Community Guide [Asthma Control: Home-based Multi-trigger Multicomponent Environmental Interventions](http://www.thecommunityguide.org/asthma/multicomponent.html) (www.thecommunityguide.org/asthma/multicomponent.html).

Actions Addressing Childhood Lead Poisoning

The MDH Lead and Healthy Homes Program is a leader for childhood lead poisoning prevention efforts statewide, working toward the elimination of childhood lead poisoning as a public health problem through lead education, by identifying at-risk homes and children, and supporting people exposed to lead (Minnesota Department of Health, 2010).

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Efforts to reduce lead exposure may be resulting in fewer cases of elevated blood lead among Minnesota children. This is similar to trends across the nation. Housing rehabilitation programs, such as those funded by the U.S. Department of Housing and Urban Development (HUD), have focused on making homes lead-safe. Lead has also been eliminated from paint, gasoline, and many consumer products and children's toys. Lead-related manufacturing has also introduced greater controls to reduce occupational and environmental lead exposures.

Recent State Policies Addressing Chemical Exposures in Children

In *The Price of Pollution* (Schuler, Nordbye, Yamin & Ziebold, 2006), the policy recommendations to address these costs in Minnesota included phasing out chemicals in certain products; reforming regulation to prevent exposure, and improved data collection through the establishment of a system for disease tracking and biomonitoring (Schuler et al., 2006). In recent years, the Minnesota Legislature has passed several significant laws to address these recommendations.

The *Toxic Free Kids Act* (MN Statutes, sections 116.9401 - 116.9407) was passed in 2010. This law requires MDH to create two lists of chemicals: one list called "Chemicals of High Concern" and one called "Priority Chemicals." Through this program, MDH is identifying the potential for hazardous chemical exposures which may be harmful to health, particularly to children and pregnant women.

In 2007, the Legislature passed a law that established the *Minnesota Environmental Health Tracking and Biomonitoring Program* (MN Statutes, sections 144.995-998, 2007). This law directed MDH to collect and share existing health and environment data and to conduct a series of community-based biomonitoring projects. Today, MDH's capacity for measuring and tracking

chemicals in people (biomonitoring) has expanded beyond blood lead. MDH has monitored people in several Minnesota communities, measuring exposures to arsenic, perfluorochemicals (PFCs), mercury, lead, cadmium, bisphenol-A (BPA), parabens, and cotinine (tobacco smoke). More information about biomonitoring at MDH is available on the [Minnesota Biomonitoring Program](http://www.health.state.mn.us/biomonitoring) website (www.health.state.mn.us/biomonitoring).

Minnesota Environmental Public Health Tracking (MN Tracking)

MN Tracking brings greater availability, public access and transparency to our public health data. MN Tracking collects, analyzes and tracks data on over 20 public health topics including asthma, air quality, cancer, developmental disabilities, pesticide poisoning and childhood lead poisoning. Data are displayed in charts and maps, available online to the public on [Minnesota Public Health Data Access](https://apps.health.state.mn.us/mndata) (<https://apps.health.state.mn.us/mndata>).

In the future, MN Tracking will work to refine the methods used in this report, updating them as new data become available. MN Tracking will continue to monitor disparities in disease burden, improving the available data needed to support public health strategies that are targeted at improving health for all Minnesota's children.



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Appendix: About the Data (Technical Notes)

Childhood Asthma Data Analysis

METHODS FOR ASTHMA

The data for asthma analysis were obtained from the Chronic Disease Cost Calculator (version 2) (Centers for Disease Control and Prevention, 2013). The cost calculator was developed to provide state level estimates of medical expenditures for certain chronic diseases. Expenses included direct medical costs (physician visits, emergency department visits, hospitalizations and prescription medicine) as well as indirect costs resulting from absenteeism. Data for children in the cost calculator are only available for asthma and depression. The methods utilized by the cost calculator are described in great detail in the technical appendix for the cost calculator. Briefly, data were collected from multiple sources to estimate the treated population and per-person medical and absenteeism costs. Complex survey weights were used to incorporate data from Medicaid Statistical Information System, Current Population Survey and Medical Expenditure Panel Survey. Regression models were used to estimate the costs associated with asthma.

The number of children who died from asthma was obtained from the Asthma Program (Minnesota Department of Health, 2012). Death from asthma in children is a relatively rare event in Minnesota. To deal with annual variation in the numbers, an annual average was calculated over 5 years of data:

2007-2011. The estimate of the economic cost of premature death in children used data from Center for Tobacco Control Research and Education, University of California, San Francisco (Max, et al., 2004). The appendix of Max et al. (2004) contains present value of lifetime earnings by age. For asthma, the values for 0-17 years were averaged to get one value to assign for a premature death of a child.

All costs were converted to 2014 dollars (2014\$) using the Consumer Price Index Inflation Calculator (Bureau of Labor Statistics). The low and high end estimates of the EAF were applied to the costs to show a range of estimates of the economic burden.

Childhood Lead Poisoning Data Analysis

METHODS FOR MEAN PEAK BLOOD LEAD LEVEL (BLL)

This analysis included children born in 2004 and tested up to age 6 (2004-2010 test years), and therefore represents the status of average peak BLLs as of 2010, using the cumulative incidence of children exposed to lead up to age 6, similar to Landrigan et al. (2002).

If there were multiple lead tests between 2004 and 2010 for a child, the highest (peak) BLL was selected. Venous lead tests were selected over capillary tests because capillary tests have a greater rate of false positives. Detectable results were preferred over BLLs below the limit of detection (LOD), also known as nondetects. The LOD changes depending on the laboratory due to differences in analytic methods, equipment, and reporting limits. Nondetects were addressed using robust linear regression on order statistics (ROS) methods, which applies a theoretical distribution to the data in order to calculate a mean and confidence interval.

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RESULTS FOR MEAN PEAK BLL

The average peak blood lead level (BLL) among children born in 2004 and tested up to age 6 is 2.5 micrograms of lead per deciliter of blood ($\mu\text{g}/\text{dL}$). This estimate is specific to Minnesota children testing for blood lead.

About 54,000 Minnesota children born in 2004 were tested before the age of 6, or about 76% of the 2004 birth cohort. Lead testing is not universal in Minnesota. Instead, high risk children (such as those that live in older housing that may have lead-based paint) are targeted for lead testing. Because lead testing in Minnesota is targeted and not random, any measures calculated using lead testing data are not generalizable and cannot be used to measure the prevalence or incidence for the overall population of children living in Minnesota.

METHODS FOR ECONOMIC COST (SEE TABLE 2)

The measurable costs of lead exposure for this report exclude crime due to lead exposure as well as health, earnings, and welfare use due to loss of IQ from lead exposure (Muennig, 2009). Landrigan et al. 2002 only includes the direct effect of lost IQ points on lifetime earnings, as does the MN Center for Advocacy's *The Price of Pollution* (Schuler, Nordbye, Yamin & Ziebold, 2006). Therefore, we calculated the economic burden of lead poisoning using only lost lifetime earnings.

Using Canfield (2003) to convert BLLs into loss of IQ points, there is an estimated loss of 0.47 IQ points (ranging from 0.25 to 0.70 IQ points lost) for every 1 $\mu\text{g}/\text{dL}$ increase in BLLs (see Table 2, unadjusted estimate of IQ loss using the peak blood lead at 5 years of age). Therefore, the 2004 birth cohort in Minnesota has lost an average of approximately 1.25 IQ points per child due to the cumulative incidence of lead poisoning up to age 6.

According to Landrigan (2002), there is a loss of 2.39% of lifetime earnings for every IQ point loss. Therefore, the 2004 birth cohort in Minnesota has lost an average of 2.98% of lifetime earnings.



RESULTS FOR ECONOMIC COST (SEE TABLE 3)

Market productivity data were obtained for boys and girls separately (Grosse, et al., 2009). The total lifetime earnings (in market productivity) was \$1,055,542 for boys and \$622,653 for girls (2007\$). Multiplying those amounts by 2.85% in lifetime earnings lost equates to \$30,117 lost per boy and \$17,765 lost per girl. There were 35,988 boys and 34,626 girls in the 2004 birth cohort in Minnesota, which equates to \$1.1 million lost in lifetime earnings for boys and \$615 thousand lost in lifetime earnings for girls in the 2004 birth cohort overall. That sums to \$1.7 billion (2007\$), and by applying an inflation index from the Consumer Price Index calculator (Bureau of Labor Statistics) to convert to 2014 dollars, the total economic burden of childhood lead poisoning in Minnesota on lifetime earnings comes to \$1.9 billion (in 2014\$). In summary, the mean peak blood lead level in the 2004 birth cohort, through a decrease in IQ points due to lead exposure and a subsequent loss in lifetime earnings, resulted in a total economic burden of \$1.9 billion (2014\$).

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Limitations of this analysis

COSTS LIKELY UNDERESTIMATE THE TRUE ECONOMIC BURDEN

This report addresses specific costs that are measurable with the available data and focuses on environmental risks that are amendable to change. Several costs are not included in the estimates. For example, the costs to treat childhood lead poisoning or conduct environmental assessments of lead exposure are not included, either because the cost is at least an order of magnitude smaller than the cost of lost lifetime earnings or because the cost cannot be estimated. This report does not capture the longer term effects of environmental exposures that occur at a young age, but do not appear as disease until later in life. Therefore, **the costs calculated in this report likely underestimate the true cost to Minnesota's economy of asthma episodes and lead poisoning in children that are attributable to environmental risk factors.**

THE ENVIRONMENTALLY ATTRIBUTABLE FRACTION (EAF) IS AN UNCERTAIN ESTIMATE

The EAFs for asthma used in this report are based on published scientific studies that measure the relationship between specific risks and disease in populations. However, estimating the EAF is itself not a scientific measurement, but is based on judgment by experts. The studies used to estimate the EAFs are not specific to Minnesota populations, and the estimates do not include the most recent science published in the past few years. The true fraction of these diseases that is attributable to environmental factors in Minnesota is unknown. The EAF can change over time in a given population, and it can be different from one population to the next. The EAF can also be modified over time by better population health care that leads to reduced population vulnerability, and environmental interventions that reduce exposure.



THE HEALTH AND ECONOMIC BURDEN IS NOT SHARED EQUALLY

We know that **the burden and cost of environmentally attributed disease in Minnesota's children is not shared equally across all communities of the state.** Ample evidence points to significant disparities in our state with respect to the occurrence of childhood asthma episodes, and the prevalence of blood lead poisoning, both of which are known to be greater in lower income communities. In addition, environmental exposures to pollutants are not shared equally. For example, residential communities located close in proximity to high traffic corridors experience greater pollutant levels from vehicle exhaust. Communities that are economically disadvantaged are less able to take actions to avoid environmental risks in their homes and neighborhoods, which further leads to a disparate burden.

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For more information, contact:
Minnesota Department of Health
Minnesota Environmental Public Health Tracking
PO Box 64882, St. Paul, MN 55164-0882

Phone: 651-201-5900
Toll Free: 1-800-205-4987

Email: health.tracking@state.mn.us

