

# Lead Poisoning

## 1. DISEASE REPORTING

### 1.1 Purpose of Reporting and Surveillance

1. To assess the magnitude of lead exposure in Oregon.
2. To identify all tested individuals with elevated blood lead levels (EBLL).
3. To identify the sources of lead exposure for individuals with EBLL and to identify, notify, and evaluate others who may be at risk from those sources.
4. To ensure that individuals with EBLL receive proper medical management, including follow-up, until their blood lead concentration drops to acceptable levels.
5. To ensure that adequate environmental follow-up occurs, to reduce or eliminate the risk of further lead exposure from identified sources for the affected child and any family members, playmates, etc. who could also be exposed to the same source.
6. For occupational exposures, to ensure that the Oregon Occupational Safety and Health Division (OR-OSHA) is aware in a timely manner.

### 1.2 Laboratory Disease Reporting Requirements

1. Laboratories must report all blood lead test results directly to the local health authority or Oregon Health Authority (OHA) within seven days [[333-018-0015 4\(d\)](#)]. Lead poisoning ( $\geq 5\mu\text{g/dL}$  under 18 years of age,  $\geq 10\mu\text{g/dL}$  over 18 years) must be reported within one local health department working day [[333-018-0015 4\(c\)](#)]; results may be sent electronically or faxed to (971) 673-0457.
2. Oregon law requires labs that send an average of  $>30$  records per month to OHA to submit the data electronically. Please contact OHA at 971-673-1111 for Electronic Laboratory Reporting (ELR) initiation, assistance and approval.

### 1.3 Clinician Disease Reporting Requirements

1. Clinicians using point-of-care portable analyzers for blood lead testing are required to report all blood lead test results directly to the local health authority or OHA within seven days [[333-018-0015 4\(d\)](#)]. Lead poisoning (see definition) must be reported within one local health department working day [[333-018-0015 4\(c\)](#)]; results can be sent electronically or faxed to (971) 673-0457. For more information on reporting, contact OHA at 971-673-0440.

### 1.4 Local Health Authority Reporting and Follow-Up Responsibilities

1. OHA will refer childhood EBLL reports received directly from labs or clinicians to Local Public Health Authorities (LPHA) for follow-up. If the LPHA is notified directly of an EBLL test result, they should report the case to OHA via the Oregon Public Health Epidemiologists' User System (Orpheus).
2. Forms used for reporting and recording the results of follow-up investigations are available from the Lead Poisoning Prevention Program at (971) 673-0440 or at [www.healthoregon.org/lead](http://www.healthoregon.org/lead). Except for initial reporting, different forms are used for children and adults; they are listed in **Tables 1**. Fax completed forms to the Lead Poisoning Prevention Program at (971) 673-0457, mail to 800 NE Oregon St., Suite 640, Portland, OR 97232, or upload directly to the case inside Orpheus.

**Table 1. Lead Poisoning Forms for Children (< 18 years old)**

Form Title	Form Number	Usage
<a href="#"><u>Elevated Blood Lead Reporting Form</u></a>	Report electronically via Orpheus or Fax	All cases with BLL $\geq$ 5 $\mu$ g/dL
<a href="#"><u>Elevated Blood Lead Investigation Questionnaire</u></a>	OCLPPP EIQ 01	All confirmed EBLs $\geq$ 5 $\mu$ g/dL

## 2. LEAD POISONING AND ITS EPIDEMIOLOGY

### 2.1 Background

Lead is a naturally occurring soft metal found in rocks and soil. Throughout history, it has been used for a variety of purposes (e.g. glazing pottery, soldering). Characteristic features of lead toxicity, including anemia, colic, and coma, were noted by Hippocrates in ancient times.<sup>1</sup> Lead serves no useful biologic purpose in the human body, and recent evidence demonstrates that multiple health effects can occur at lead levels once considered safe.<sup>2</sup> The insidious nature of lead poisoning means that the only way to know if an adult or child has an EBLL is to perform a blood test. Lead poisoning continues to be an important environmental and occupational health problem. For more information on sources of lead exposure, see Section 8.

### 2.2 Description of Illness

#### A. Absorption and Distribution

Ingestion and inhalation are the typical routes of lead exposure. The most common source of lead exposure for children is ingestion of lead-containing dust. The rate of lead uptake is affected by an individual's developmental stage, route of exposure, and nature of the lead compounds to which the individual is exposed. Nutritional status is also important; a healthy diet high in iron and calcium and low in fat may slow the rate of lead absorption.

Absorption depends on the form of the lead. Inhaled, airborne lead is almost totally absorbed, while ingested lead absorption rates may vary from 10% in adults to 50% in children and pregnant women. Lead is absorbed more efficiently from dust from sanded lead-based paint than from whole paint chips. The most dangerous exposure is to lead vapors (formed whenever lead is melted) or other respirable lead compounds. Absorbed lead is detectable in blood, soft tissue and bone. The half-life of lead varies from about a month in blood, 1-1.5 months in soft tissue, and about 25-30 years in bone.<sup>3</sup>

For the purposes of these guidelines, persons with EBLs are considered to have lead poisoning. Lead poisoning can affect both children and adults, although the effects may vary markedly with age. It is convenient, albeit somewhat artificial, to divide lead poisoning into an acute disease that relates to current BLLs, and a chronic disease that relates to the cumulative effects of body lead burden. In both cases, the most prominent signs and symptoms are neurological. Bear in mind that persons with very high BLLs ( $\geq 70$   $\mu\text{g}/\text{dL}$  in children,  $\geq 100$  in adults) should be treated as medical emergencies, regardless of overt symptoms. Ingestion of a metallic object that may contain lead can result in an EBL within hours. Ingestion of any object that may contain lead should be treated as a medical emergency and treatment should include a blood lead test and abdominal x-ray.

#### **B. Acute Disease**

Acute exposure to lead generally means exposure for a short time, but at high levels. Blood lead levels increase quickly after an acute exposure. The most common symptom of acute lead poisoning is colicky abdominal pain evolving over days to weeks. Constipation, diarrhea, and nonspecific complaints of irritability, fatigue, weakness and muscle pain may also occur. These symptoms are seldom caused by BLLs less than 50  $\mu\text{g}/\text{dL}$ . In more severe cases, warning signs of acute, serious brain swelling include vomiting, irritability, restlessness, tremors, and progressive drowsiness. These symptoms may herald the onset of seizures, coma, and possibly death. The BLLs associated with encephalopathy in children vary from study to study, but BLLs of 70-80  $\mu\text{g}/\text{dL}$  or greater appear to indicate a serious risk.<sup>3</sup>

#### **C. Chronic Effects**

Chronic lead exposure generally means exposure to lead over a long period. Recent studies suggest that lead absorption is harmful at any concentration and that no safe level of lead exposure exists.<sup>2,4</sup> Relatively low blood lead levels rarely cause overt signs and symptoms, but such exposure can cause permanent damage—especially in young children—including decreased IQ, developmental delays and behavioral disturbances. In adults, late effects of chronic lead toxicity include chronic renal failure, hypertension, gout, and chronic encephalopathy.<sup>5</sup>

## **3. TESTING METHODS AND CASE DEFINITIONS**

### **3.1 Testing Methods**

Blood lead testing is the only acceptable laboratory test for screening and confirming lead poisoning. Venipuncture is preferred for specimen collection, but capillary testing is acceptable if care is taken to properly clean and prepare the finger. Capillary samples are easier to contaminate because of the possibility of lead containing dust and dirt on the hand or under the fingernails. All

capillary BLLs of  $\geq 5 \mu\text{g/dL}$  (children or pregnant women) or higher must be followed with a confirmatory venous test.

Several tests have been found to be insensitive and/or imprecise as screening tests for lead and are not recommended. These include: erythrocyte protoporphyrin (EP) measured as either free erythrocyte protoporphyrin (FEP) or zinc protoporphyrin (ZPP); basophilic stippling; urine testing; and assays of hair or fingernail lead levels.

### 3.2 Case Definitions

In 1991, CDC defined BLLs of  $\geq 10 \mu\text{g/dL}$  as the “level of concern” for children aged 1-5 years. Based on a growing body of studies of adverse health effects with BLLs less than  $10 \mu\text{g/dL}$ , CDC changed the term “level of concern” to “reference value”, to reinforce that there is not a recognized safe level of lead exposure. On May 13, 2012, CDC adopted the reference value of  $\geq 5 \mu\text{g/dL}$ . OHA adopted the reference value of  $\geq 5 \mu\text{g/dL}$  in 2016.

LPHAs are expected to conduct case management activities for children and pregnant and lactating women according to the public health action levels listed in Table 2. LPHAs may request technical assistance from OHA in conducting case management activities as needed. OHA will provide and/or arrange periodic training to LPHA staff on case management procedures. The goal is to ensure that all children and pregnant and lactating women with a lead poisoning case receive the appropriate care.

**Table 2. Lead Poisoning Case Definitions**

Population	Surveillance	Reference Value/Case Definition
Children (< 18 years old)	All BLLs	$\geq 5 \mu\text{g/dL}$
Pregnant and Lactating Women	$\geq 5 \mu\text{g/dL}$	$\geq 5 \mu\text{g/dL}$
Adults ( $\geq 18$ years old)	$\geq 5 \mu\text{g/dL}$	$\geq 10 \mu\text{g/dL}^*$

\*LPHAs are not expected to conduct case management activities for adults (with the exception of pregnant and lactating women). OHA conducts investigations for adult cases and will alert LPHAs only when there is concern for the health of other household members.

## 4. SCREENING SCHEDULES AND MEDICAL MANAGEMENT

### 4.1 Overview

The goal of lead screening is to identify individuals who have been exposed to lead, provide appropriate interventions and reduce the risk of future exposure. If an EBLL is detected, the nature of care and the frequency of follow-up testing vary with the patient’s age and BLL. Whatever the

age, individuals with EBLLs (or their caregiver) should be educated about what lead poisoning is and what they can do about it. **The single most important factor in managing lead poisoning is identifying and reducing exposure to lead.** A variety of culturally-appropriate educational pamphlets are available; they should be sent to the family or individual identified as having an EBLL.

#### 4.2 Anticipatory Guidance

Anticipatory guidance regarding lead hazard identification and risk reduction measures should be a routine part of an ongoing educational approach for pregnant women, children and their families. Medical providers should provide source identification and risk reduction educational materials. There is no safe level of lead and the majority of children and adults in the U.S. have blood lead levels less than 2 µg/dL.<sup>6</sup> Individuals should reduce lead exposure and maintain the lowest possible blood lead level.

Lead exposure during pregnancy is especially problematic as lead can cross the placenta and interfere with normal development of the fetal brain. Pregnant women can be exposed to lead through all of the sources described previously. Pregnant women or women likely to become pregnant should try to avoid exposure and maintain lead levels below 5 µg/dL and as low as possible. Anticipatory guidance should focus on decreasing the risk of exposure to lead by advising against activities such as remodeling or repainting the baby's room or restoring old furniture. For women exposed occupationally, discuss personal protective equipment and consider contacting the employer to encourage reducing exposure. OHA can assist with occupational exposures.

#### 4.3 Screening Protocols for Children

All children should be assessed for risk of lead poisoning by administration of the Oregon Lead Risk Assessment Questionnaire (see below). This questionnaire should be administered at 1 and 2 years of age, or between 3 and 5 years of age if not previously screened. If the answer to any question is "Yes" or "Don't know," a blood lead test should be performed. Follow-up questions may be needed to clarify responses. Children who are enrolled in [Medicaid](#) are required to be tested (not screened) at 12 and 24 months.

- ❖ Has your child lived in or regularly visited a home, childcare or other building built before 1950?
- ❖ Has your child lived in or regularly visited a home, childcare or other building built before 1978 with recent or ongoing painting, repair and/or remodeling?
- ❖ Is your child enrolled in or attending a Head Start program?
- ❖ Does your child have a brother, sister, other relative, housemate or playmate with lead poisoning?
- ❖ Does your child spend time with anyone that has a job or hobby that may involve lead?  
*Examples: painting, remodeling, auto radiators, batteries, commercial recycling, auto repair, soldering, making sinkers, bullets, stained glass, pottery, going to shooting ranges, hunting or fishing.*
- ❖ Do you have pottery or ceramics made in other countries, or leaded crystal or pewter that are used for cooking, storing or serving food or drink?
- ❖ Has your child ever taken any traditional home remedies or used imported cosmetics?  
*Examples: Azarcon, Alarcon, Greta, Rueda, Pay-loo-ah, Surma, or Kohl*

- ❖ Has your child been adopted from, lived in or visited another country?
- ❖ Do you have concerns about your child’s development or behavior?
- ❖ Do you live near an automotive repair shop, recycling center, factory or manufacturing plant (for batteries, plumbing fixtures, ammunition, glass, paint and pigments), firing range, bridge or highway construction, or other industry likely to release lead?  
*For more examples, see Table 5, Section 8.*

#### 4.4 Screening Protocols for Pregnant and Lactating Women

The purpose of screening pregnant women is to identify women exposed to lead who can benefit from the knowledge of their lead exposure and prevent additional exposure or adverse effects to themselves or their fetuses. Identifying maternal lead exposure prior to conception or early in the pregnancy offers the most benefit to the fetus. The following questionnaire should be administrated at the earliest contact with the patient. If the answer to any question is “Yes” or “Don’t know,” a blood lead test should be performed. Follow-up questions may be needed to clarify responses.

- ❖ Do you live in a house or apartment building built before 1978 with recent or ongoing remodeling, repairs or painting?
- ❖ Do you or anyone in your household have a job or hobby that may involve lead?  
*Examples: painting, remodeling, auto radiators, batteries, commercial recycling, auto repair, soldering, making sinkers, bullets, stained glass, pottery, going to shooting ranges, hunting or fishing.*
- ❖ Have you recently eaten or chewed crushed pottery, soil, paint chips, clay, or other things that are not food?
- ❖ Do you have pottery or ceramics made in other countries, or leaded crystal or pewter that are used for cooking, storing or serving food or drink?
- ❖ Have you recently taken any traditional home remedies or used imported cosmetics?  
*Examples: Azarcon, Alarcon, Greta, Rueda, Pay-loo-ah, Surma, or Kohl*
- ❖ Have you recently lived in or visited another country?
- ❖ Do you live near an automotive repair shop, recycling center, factory or manufacturing plant (for batteries, plumbing fixtures, ammunition, glass, paint and pigments), firing range, bridge or highway construction, or other industry likely to release lead?  
*For more examples, see Table 5, Section 8.*

#### 4.5 Diagnostic Blood Lead Testing

Blood lead testing should also be considered as part of a diagnostic work-up of any individual regardless of age with the following symptoms:

- ❖ **Behavioral problems (applies to children):** aggression, hyperactivity, attention deficit, school problems, learning disabilities, excessive mouthing or pica behavior and other behavior disorders.

- ❖ **Developmental problems (applies to children):** growth, speech and language delays and/or hearing loss.
- ❖ **Symptoms or signs consistent with lead poisoning:** irritability, headaches, vomiting, seizures or other neurological symptoms, anemia, loss of appetite, abdominal pain/cramping or constipation.
- ❖ **Ingestion of foreign body.**

#### 4.6 Follow-up for Elevated Blood Lead Results

##### A. Childhood Cases

Any capillary BLL test result at or above 5 µg/dL must be confirmed with a venous sample. The higher the BLL on the capillary test, the more urgent the need for venous confirmatory testing.

**Exception to confirmatory testing schedule:** If recent known exposure (e.g. foreign body ingestion, recent remodeling), confirm as soon as possible for all blood lead levels.

**Table 3** is to be used as guidance. Case managers and clinicians should consider individual patient characteristics and caregiver capabilities and adjust the frequency of follow-up tests accordingly.

**Table 3. Follow-up Schedule for Blood Lead Results in Children**

BLL (µg/dL)	Confirmation Testing (venous)	Follow-Up Testing (venous)	Case Management for BLLs in Children
5-9	As soon as possible, or within 7-14 days	3 months	<p><b>Clinician case management:</b></p> <ul style="list-style-type: none"> <li>• Perform confirmatory testing. Confirm recent known exposure as soon as possible.</li> <li>• Provide risk reduction education</li> <li>• Provide nutritional education and refer to WIC as needed. If WIC enrolled, notify local WIC program of EBLL for nutritional assessment.</li> <li>• Ensure follow-up testing by established timeframe.</li> <li>• Include history of EBLL in problem list of child’s permanent medical record.</li> <li>• See CDC guidelines for more medical management recommendations.</li> </ul> <p><b>LPHA case management:</b></p> <ul style="list-style-type: none"> <li>• Contact caregiver regarding child’s BLL.</li> <li>• Ensure case is confirmed with venous test <b>before</b> investigating, either with physician or parent.</li> <li>• Complete <a href="#">Elevated Blood Lead Investigation Questionnaire</a> over phone to explore possible exposure sources.</li> <li>• Complete on-site investigation to identify lead hazards. Follow procedures outlined in Section 7, <i>Environmental Investigation Procedures</i>. If on-site investigation is not practical or feasible (as determined on a case-by-case basis), a phone interview using the <a href="#">Elevated Blood Lead Investigation Questionnaire</a> may be acceptable.</li> <li>• Refer to housing remediation services if applicable and/or available.</li> </ul>

BLL (µg/dL)	Confirmation Testing (venous)	Follow-Up Testing (venous)	Case Management for BLLs in Children
			<ul style="list-style-type: none"> <li>Send environmental sampling results (and those performed by OHA) and follow-up recommendations in letter to family</li> <li>Send copy of questionnaire to and follow-up letter to clinician.</li> <li>Refer family to WIC, social services, public assistance, early intervention or housing remediation services if applicable and/or available.</li> <li>Ensure follow-up testing by established timeframe.</li> </ul>
10-19	As soon as possible, or within 7 days	3 months	<p><b>Clinician case management:</b> ALL OF THE ABOVE.</p> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>
20-44	As soon as possible, or within 7 days	1 month	<p><b>Clinician case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>Children with BLLs <math>\geq 20</math> µg/dL should have a medical examination.</li> <li>Conduct neurodevelopmental monitoring.</li> </ul> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>
45-59	As soon as possible, or within 2 days	Chelation* with subsequent follow-up.	<p><b>Clinician case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>Chelation therapy. Follow-up testing schedule determined by medical provider.</li> </ul> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>
60-69	As soon as possible, or within 1 day	Chelation* with subsequent follow-up	<p><b>Clinician case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>Chelation therapy. Follow-up testing schedule determined by medical provider.</li> </ul> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>
$\geq 70$	Immediately as an emergency lab test	Chelation* with subsequent follow-up	<p><b>Clinician case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>Hospitalize child for chelation therapy immediately. Follow-up testing schedule determined by medical provider. The child should not be permitted to return to any environment that would expose him/her to lead.</li> </ul> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>

\*While chelation therapy is considered a mainstay in the medical management of children with BLLs  $\geq 45$  µg/dL, it should be used with caution. Unless the clinician is intimately familiar with treatment protocols, he/she should consult with an expert such as one of the following prior to using chelation agents:<sup>7,8</sup>

- Medical toxicologist
- Clinician experienced in treating children with elevated BLLs
- [Northwest Pediatric Environmental Specialty Health Unit \(PESHU\)](#)
- Center with expertise in the management of lead chemotherapy. Clinicians may contact the [Oregon Poison Center](#) or the [CDC Childhood Lead Poisoning Prevention Program](#) (404-498-1420) for the names of accessible experts.



### C. Pregnant and Lactating Women

Any capillary BLL test result  $\geq 5 \mu\text{g}/\text{dL}$  must be confirmed with a venous sample. The higher the BLL on the capillary test, the more urgent the need for venous confirmatory testing. **Exception to confirmatory testing schedule:** If recent known exposure (e.g. foreign body ingestion, recent remodeling), confirm as soon as possible for all blood lead levels.

**Table 4** is to be used as guidance. Case managers and clinicians should consider individual patient characteristics and caregiver capabilities and adjust the frequency of follow-up tests accordingly. See CDC's [Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women](#) for more recommendations.

**Table 4: Follow-up Schedule for Elevated Blood Lead Results in Pregnant and Lactating Women**

BLL ( $\mu\text{g}/\text{dL}$ )	Confirmation Testing (venous)	Follow-Up Testing (venous)	Case Management for BLLs in Pregnant and Lactating Women
5-9	As soon as possible, or within 7-14 days	1 month	<p><b>Clinician case management:</b></p> <ul style="list-style-type: none"> <li>• Perform confirmatory testing. Confirm recent known exposure as soon as possible.</li> <li>• Obtain a maternal BLL prior to delivery, or cord BLL at delivery. More frequent testing may be indicated based on risk factor history.</li> <li>• Provide risk reduction education and counsel on avoiding further exposure, including pica behavior.</li> <li>• Provide nutritional education and refer to WIC as needed. If WIC enrolled, notify local WIC program of EBLL for nutritional assessment.</li> <li>• Ensure follow-up testing by established timeframe.</li> <li>• Assess nutritional adequacy and counsel on eating a balanced diet with adequate iron and calcium intake, through either diet or supplementation or a combination of both.</li> </ul> <p><b>LPHA case management:</b></p> <ul style="list-style-type: none"> <li>• Contact patient confirming BLL.</li> <li>• Complete <a href="#">Elevated Blood Lead Investigation Questionnaire</a> over phone to explore possible exposure sources.</li> <li>• Complete on-site investigation to identify lead hazards. Follow procedures outlined in Section 7, <i>Environmental Investigation Procedures</i>. If on-site investigation is not practical or feasible (as determined on a case-by-case basis), a phone interview using the <a href="#">Elevated Blood Lead Investigation Questionnaire</a> may be acceptable.</li> <li>• Send environmental sampling results (and those performed by OHA) and follow-up recommendations in letter to family</li> <li>• Send copy of questionnaire to and follow-up letter to clinician.</li> </ul>

BLL (µg/dL)	Confirmation Testing (venous)	Follow-Up Testing (venous)	Case Management for BLLs in Pregnant and Lactating Women
			<ul style="list-style-type: none"> <li>Refer patient to WIC, social services, public assistance, early intervention or housing remediation services if applicable and/or available.</li> <li>For lactating women, breastfeeding should be encouraged.</li> <li>For occupationally exposed women, discuss personal protective equipment and refer to the <a href="#">Oregon Occupational Public Health Program</a>.</li> <li>Ensure follow-up testing by established timeframe.</li> </ul>
10-14	As soon as possible, or within 7 days	1 month	<p><b>Clinician case management:</b> ALL OF THE ABOVE.</p> <p><b>LPHA case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>Refer occupationally exposed women to occupational medicine specialist and remove from workplace lead exposure.</li> </ul>
15-24	As soon as possible, or within 7 days	Within 1 month and then every 2-3 months.	<p><b>Clinician case management:</b> ALL OF THE ABOVE.</p> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>
25-44	As soon as possible, or within 7 days	Within 1-4 weeks and then every month	<p><b>Clinician case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>For lactating women with BLLs &lt;40, breastfeeding should be encouraged.</li> <li>For lactating women with BLLs ≥40, lactation should be continued, but breast milk should be pumped and discarded until BLLs &lt;40.</li> </ul> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>
≥45	As soon as possible, or within 2 days	Within 24 hours and then at frequent intervals depending on clinical interventions and trend in BLLs.	<p><b>Clinician case management:</b> ALL OF THE ABOVE, PLUS:</p> <ul style="list-style-type: none"> <li>Consultation with a clinician experienced in the management of pregnant women with BLLs in this range is strongly advised.</li> <li>Treat as high-risk pregnancy and consult with an expert in lead poisoning on chelation and other treatment decisions.</li> </ul> <p><b>LPHA case management:</b> ALL OF THE ABOVE.</p>

### C. Adult Cases

LPHAs are not expected to conduct case management activities for adults (with the exception of pregnant and lactating women). OHA conducts investigations for adult cases and will alert LPHAs only when there is concern for the health of other household members.

**Table 5: Follow-up Schedule for Elevated Blood Lead Results in Adults**

<b>BLL (µg/dL)</b>	<b>OHA Case Management for BLLs in Adults</b>
5-9	<ul style="list-style-type: none"> <li>• Surveillance only.</li> <li>• No case management in this range unless associated with an exposure event that involves multiple individuals.</li> <li>• OHA will provide surveillance data to Oregon OSHA.</li> </ul>
10-24	<ul style="list-style-type: none"> <li>• OHA will contact individual via letter after receiving an initial, confirmed BLL in this range. Adult Lead Case Interview form and educational materials will be included with the letter.</li> <li>• If no contact information is available, then the ordering physician will be contacted by OHA. Contact information for the individual as well as information regarding occupation/employer will be requested.</li> <li>• OHA will provide surveillance data to Oregon OSHA.</li> </ul>
>=25	<p>ALL OF THE ABOVE, PLUS</p> <ul style="list-style-type: none"> <li>• OHA will contact the ordering physician to obtain suspected source of exposure and determine whether other household members, especially children and pregnant and lactating women, may also be at risk of exposure.</li> <li>• If the exposure is related to the individual’s occupation and it is the initial test result in this range, then OHA will notify Oregon OSHA immediately following contact with patient or physician.</li> </ul>
≥60	<ul style="list-style-type: none"> <li>• BLLs at this level should be considered urgent.</li> <li>• The Oregon Poison Center (1-800-222-1222) is a referral source for physicians requesting advice on treatment of adults.</li> <li>• The greatest concern with adult cases is determining the source of exposure and determining whether other individuals are at risk from the same lead source.</li> </ul>

## 5. MANAGING SPECIAL SITUATIONS

### 5.1 Lead Exposure during Pregnancy or Breastfeeding

Lead exposure during pregnancy is especially problematic since lead can cross the placenta and interfere with normal development of the fetal brain. High levels of lead during pregnancy can also cause miscarriage, stillbirth, low infant birth weight and premature delivery. Pregnant women can be exposed to lead through all of the sources described previously. Because lead is stored in bone, women who have worked or been exposed to lead in the past may have higher lead levels because lead can be released into the blood during pregnancy. Pregnant or women likely to become pregnant should try to avoid exposure and maintain lead levels below 5 µg/dL and as low as possible. Guidance for pregnant women should focus on proper nutrition, sources of lead exposure and ways to reduce exposure before and during pregnancy. Risk factors such as pica, poor nutrition, country of origin, immigrant status, hobbies and occupations should be discussed. Women exposed occupationally may need special risk-reduction counseling and should be referred to Oregon OSHA or the Lead Poisoning Prevention Program. For more information on lead exposure during pregnancy and breastfeeding, see CDC’s [Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women](#).

### 5.2 Chelation Therapy

Chelating agents solubilize lead, depleting it from soft and hard tissue and thereby reducing its acute toxicity. While chelation therapy is considered a mainstay in the medical management of children with BLLs  $\geq 45$   $\mu\text{g}/\text{dL}$ , it should be used with caution. Treatment with chelating agents lowers BLLs, but does not improve scores on tests of cognition, behavior, or neuropsychological functions except in patients with extremely high BLLs. Primary care providers (PCP) should consult with the Oregon Poison Center prior to using chelating agents. In the short term, chelation can redistribute body lead, causing an increase in lead concentrations in soft tissue, including the brain. Some chelators may remove essential minerals, such as calcium, iron, zinc, copper and other trace minerals, as well as lead. There is general agreement that individuals with very high BLLs (in children  $\geq 45$   $\mu\text{g}/\text{dL}$ ; in adult  $\geq 100$   $\mu\text{g}/\text{dL}$ ) should be chelated. Patients with lower BLLs (children  $< 25$   $\mu\text{g}/\text{dL}$ ; adults  $< 65$   $\mu\text{g}/\text{dL}$ ) are usually not chelated unless symptomatic and/or unresponsive after removal from exposure. For patients with in-between BLLs, chelation may or may not be appropriate.

## 6. CASE CLOSURE (APPLIES TO CHILD CASES ONLY)

### 6.1 Laboratory Case Closure

Child's BLL has declined to below 5  $\mu\text{g}/\text{dL}$  on two consecutive tests at least three months apart.

### 6.2 Administrative Case Closure

Child's case is lost to follow-up. If child/family moves out of state, please notify the Lead Poisoning Prevention Program so they can notify the health department in the state where the child has relocated. The case may also be closed if the medical provider or family does not plan on further follow-up testing. There should be at least three documented attempts to contact the family, whether by phone or letters. If possible, the last attempt to reach the family should be through certified mail.

## 7. ENVIRONMENTAL INVESTIGATION PROCEDURES

### 7.1 Environmental Investigation Procedures for Homes of Children with EBLLs

- ❖ **Communicating with parent/guardian:** Determine language and literacy. If non-English speaking, arrange for an interpreter. Select appropriate educational materials based on language and reading level.
- ❖ **Schedule Interview/Investigation:** Ask the parent/guardian when a good time for an interview would be and who will be present. Most small children have a regular schedule. Work with the family's schedule.
- ❖ **Determine Age of Housing:** Contact county tax assessor's office or website to determine age of housing (many people do not know this information). Older housing (pre-1950) is more likely to have lead-based paint and a higher concentration of lead in the paint. Any pre-1978 housing is considered suspect for lead paint.
- ❖ **Visit the Home:**

1. Fill out the [Elevated Blood Lead Investigation Questionnaire](#) and follow the guidelines listed in this section while conducting the investigation.
2. **Visual Assessment:** Use your inspection and observation skills to assess the environment. A list of things to look for is on the following page.
3. **Administer/Review Screening Questionnaire:** Administering the [Lead Screening Parent Questionnaire](#) in person will enable you to observe parent/guardian reactions to questions. Questionnaire is designed to help discover potential lead exposure sources. Follow-up questions may be needed to clarify responses. Get answers to every question. Even if the answer is “Don’t know”, record it. Take time to review unclear or incomplete answers on questionnaire. Ask open-ended questions whenever possible, but do not ask leading questions.
4. **Note and follow up on all possible exposure sources:** Frequently there are more than one identifiable source. Do not jump to conclusions. Keep an open mind.
5. **Take environmental samples and/or test items suspected to contain lead:** Follow the instructions listed in Section 7.3.

❖ **Communicate Results of Investigation:** Use letter templates available at [www.healthoregon.org/lead](http://www.healthoregon.org/lead) or write a letter to the parents/guardians explaining the following:

- When and why you visited their home;
- What items were tested, any samples taken and where, and the results;
- If lead hazards were found, what do they mean;
- What parents can do to address any lead hazards found;
- Identify local remediation resource if available, advise need for follow-up blood lead testing (coordinate with PHN if applicable), and send additional educational materials as needed.
- Upload copy of questionnaire, testing results, follow-up letter, and all case management documentation to Orpheus. Scanned documents can be attached to the case, or results can be entered manually into the section “Enter/Review Investigation Results”.

## 7.2 What to Look for During On-Site Investigations

❖ **In Housing Built Before 1978:**

- Peeling, worn or deteriorated paint.
- Paint chips, paint dust, and any chalky residue found inside and outside the house.
- Dust in window troughs/wells, windowsills, and floors directly under windows.
- Friction or abrasion areas: windows, doors, cabinets, painted steps, etc.
- Recent remodeling activities: new surfaces, new windows, changes in floor plan, paint preparation, disturbing of paint.

❖ **In All Housing (obtain permission to check suspected items):**

- Worn or peeling paint found on furniture, toys or other household objects.
- Vinyl mini-blinds: older ones may still be a source of lead. Advise replacement of vinyl mini-blinds if these are not known to be lead-free.
- Painted or vinyl/plastic toys. Look at [toy recall list](#).
- Teeth marks or other signs of chewing on objects or surfaces
- Imported, old or improperly glazed pottery or leaded crystal: Advise not to use for food preparation, cooking, serving or storage.
- Lead-containing objects: Items like pewter serving trays, statuary, toys, fishing weights, bullets, leaded glass, etc. Advise against exposure to these objects.
- Lead-related jobs and hobbies: Home remodeling and painting, battery and radiator work, car and boat repair, shooting sports. Advise family members to avoid “take-home” lead exposures by careful hygiene practices and changing contaminated clothes at work. Store and wash work/hobby clothes separately. Restrict child’s access to lead activity areas. Employer should check Safety Data Sheets.
- Cultural medicines, home remedies and cosmetics: Look for home remedies or cosmetics that are stored in unmarked containers or have foreign labels. Expect adults to be reluctant to talk about home/cultural remedies.
- Objects containing lead solder, copper plumbing: Recommend that family run water for 30 seconds (or until cold) before use. Advise against using hot tap water for drinking, cooking and especially mixing baby food or formula.
- Other items in the yard or storage that might contain lead: Old boards, other painted building materials or old batteries.

### 7.3 Testing Items and Collecting Samples

Use [LeadCheck](#) swabs during EBLL investigations to determine the presence of lead on suspected surfaces and items. When using LeadCheck swabs, follow the [manufacturer’s instructions](#).

❖ **Testing with LeadCheck Swabs:**

- Paint:** Test any paint in poor condition in a pre-1978 home using a [LeadCheck](#) swab. Advise “lead-safe” repair or removal of all paint in poor condition, as well as the repair of any condition that causes peeling paint, leaks, poor ventilation, etc. Information on “lead-safe” remodeling is available at 971-673-0440 or [www.healthoregon.org/lead](http://www.healthoregon.org/lead).
- Blinds:** Test older, vinyl mini-blinds, as they may still be a source of lead.
- Toys:** Test any painted or vinyl/plastic toys.
- Pottery and crystal:** Test any imported, old or improperly glazed pottery, or crystal items.

❖ **Interior Environmental Samples:**

- Water:** Recommend water samples only when there is reason to suspect lead such as in well water, lead-soldered plumbing, and/or new brass fixtures.
- Medicines and cosmetics:** Take samples if appropriate. Recommend not using these medications until samples are found to be lead-free.
- Dust** Samples can only be taken by Certified Risk Assessors. Contact OHA for lead dust test kits that can be used by the parent or guardian.

❖ **Exterior Environmental Samples:**

- Soil samples can only be taken by a Certified Lead Risk Assessor. Contact OHA for assistance.
- Check exposed soil and dirt areas, especially where children and pets play. Note location of all play and bare soil areas, as well as bare areas along the dripline of the house and near roadways.
- Discuss with the certified risk assessor or OHA recommendations for mitigation of any areas of bare soil that contain elevated or hazardous levels of lead.
- Other items: Old boards and furniture, other painted building materials or old batteries. Take note of these areas and advise removal of suspect objects.

## 8. SOURCES OF LEAD EXPOSURE

### **A. Paint**

Lead was used in common house paint until 1978 when the Consumer Product Safety Commission (CPSC) restricted the amount of lead in household paint. Many buildings built before 1978 have lead-based paint both inside and outside. Housing built before 1950 is at even greater risk of having lead-based paint and will typically have a higher concentration of lead in the paint. Lead paint in good condition poses little risk. Chipping, peeling or chalking lead paint is a common source of ingestible lead dust and may be a hazard.

Lead paint is still sold internationally. Painted toys from international sources may contain lead. Hobby and industrial paint may also contain lead.

### **B. Dust**

Lead paint dust is the most common source of lead exposure for children. Lead in this form is much more easily absorbed. Interior house dust can become contaminated with lead as the result of the deterioration or disturbance of leaded paint, the tracking in of contaminated soil, and the fallout of airborne lead particulate from industrial or vehicular sources. Fine lead dust, and resulting contamination, can be created when painted surfaces rub against each other, such as where double hung windows slide up and down or when doors open and close. Lead in dust is increased after older paint has been disturbed through remodeling, renovation, paint preparation or repair.

### **C. Occupational Exposures and “Secondary Transmission”**

While lead poisoning is not a communicable disease per se, household contacts of persons with occupational, vocational, or other exposures may risk secondary transmission of lead dust or other compounds brought home. Many industries and occupations can expose a worker to lead (Table 5). Some of the occupations that carry a potential for exposure to lead include remodeling/renovation, painting, building demolition, construction, battery manufacturing and recycling, radiator repair, and bridge construction. Individuals who work in a lead environment may bring lead dust into their

car or home on their clothes and bodies, unintentionally exposing family members. Observation of good hygiene practices is important to avoid bringing lead dust into the home from the work place. These include washing or showering and changing out of work clothes/shoes before leaving for home or entering a vehicle.

If you suspect lead cross-contamination from an occupational source, consult with the OHA CLPP program about a potential OR-OSHA referral.

#### **D. Hobby Sources**

Many hobbies use lead (e.g., making or handling lead shot/bullets, fishing weights/sinkers, toy soldiers, stained glass solder, ceramic glazing, etc.). Heating and melting lead is particularly dangerous because of the formation of lead vapor, so respirator use and adequate ventilation are essential to prevent exposure. Other hobbies that carry a potential for exposure to lead include home remodeling and painting, furniture refinishing, welding, auto or boat repair, and target shooting at firing ranges. Hobbyists can protect their families by keeping the hobby activity away from living areas and by showering or changing clothes/shoes before entering the home.

#### **E. Folk Medicines and Cosmetics**

Lead has been found in some traditional (folk or home remedies) medicines used by East Indian, Indian, Middle Eastern, West Asian, and Hispanic cultures. Lead and other heavy metals are put into certain folk medicines intentionally because these metals are thought to be useful in treating some ailments. Sometimes lead accidentally gets into the folk medicine during grinding, coloring, or other methods of preparation. Medications such as *greta*, *alarcon*, *rueda* and *azarcon*, used in the Latino community for stomach ailments (*empacho*), or “*pay-loo-ah*,” similarly used by many Southeast Asians, may be as much as 90% lead by weight. Cosmetic products are a primary source of lead in Asian and Arab countries. Application of kohl or surma results in lead exposure primarily via hand-to-eye-to-mouth movement and subsequent ingestion of particles.

#### **F. Tableware**

Imported, old, handmade, or poorly glazed ceramic dishes and pottery may contain lead. Lead may additionally be present in leaded crystal, pewter and brass dishware. In these pieces, acid substances may interact chemically with the glaze and accelerate lead release. Therefore, acidic foods (such as orange, tomato and other fruit juices, tomato sauces, wines, and vinegar) stored in improperly glazed containers are potentially the most dangerous. If it is unknown whether a particular tableware item contains lead, the item should not be used to store, cook or serve food or beverages.

#### **G. Water**

Most well or city water does not naturally contain lead. Lead in drinking water is an infrequent source of lead poisoning in Oregon. Lead leaches into drinking water from brass faucets, lead solder that connects the pipes, or lead pipes. Hot water is particularly corrosive and should not be used for drinking, cooking, or preparing infant formula. Before any water is consumed, the cold-water tap should be flushed for 30 seconds to two minutes each morning, or after sitting for more than six hours, until there is a noticeable change in temperature of the water.

#### **H. Soil**



Soil may contain lead from deteriorating, exterior lead-based paint or deposition from years of leaded gasoline use or industrial emissions. Lead-contaminated soil can be tracked into the home. Children may be exposed to lead by playing in bare soil or from the soil on vegetables planted in a garden. In addition, individuals with pica may eat lead-contaminated soil. Covering bare dirt with grass or bark dust can effectively mitigate lead hazards, unless soil lead levels are extremely high.

### I. Miscellaneous Sources

Use of lead solder in the processing of canned foods in the United States has been discontinued; therefore, lead in food has been dramatically reduced. Imported food products may still contain lead as some foreign manufacturers may use lead solder in cans. Food may also be contaminated with lead from the soil during the growing process. Lead has been found in some consumer candies imported from Mexico. Certain candy ingredients such as chili powder and tamarind may be a source of lead exposure. Lead sometimes gets into the candy when processes such as drying, storing, and grinding the ingredients are done improperly. Additionally, lead has been found in the wrappers of some imported candies. The ink of these plastic or paper wrappers may contain lead that leaches into the candy. Lead has also been found in *chapulines*, dried grasshoppers often imported from Oaxaca, Mexico and prepared in traditional pottery with leaded glazes. Turmeric, a popular spice with purported health qualities, may be contaminated when lead chromate is added to the raw roots to hide pest damage and spots.

There continues to be an ever-increasing array of household products that contain lead, especially imported products. In recent years, lead has been found in vinyl mini-blinds, curtain weights, calcium supplements, hair dyes, crayons, and children’s jewelry and toys. Ingestion of any object that may contain lead should be treated as a medical emergency and treatment should include a blood lead test and abdominal x-ray.

Additional information on sources of lead exposure is available on the OHA [Lead Program website](#).

**Table 5A: Lead-related industries. Alarcon WA. Elevated Blood Lead Levels Among Employed Adults — United States, 1994–2013.** <sup>9</sup>

Industry Description	North American Industry Classification System (NAICS)
Storage battery manufacturing	33591
Alumina and aluminum production and processing	33131
Nonferrous metal (except copper and aluminum) rolling, drawing, extruding, and alloying	33149
Painting and wall covering contractors	23832
Highway, street, and bridge construction	23731
Residential building construction	23611
Remediation services	56291
Amusement and recreation industries	71399
Automotive, mechanical, and electrical repair and maintenance	81111
Fitness and recreational sports centers	71394
Copper, nickel, lead, and zinc mining	21223

**Table 5B: Lead-related Occupations.** <sup>10</sup>

Occupation	Source of Exposure
Artists	Materials used may contain lead
Auto repairers	Car parts may contain lead
Battery manufacturers	Batteries contain lead
Bridge reconstruction workers	Old paint may contain lead
Construction workers	Materials used may include lead
Firing range instructors and gunsmiths	Ammunition contains lead
Glass manufacturers	Lead may be used in glass production
Lead manufacturers, miners, refiners and smelters	
Manufacturers of bullets, ceramics, and electrical components	All products may contain lead
Painters	Old paint and commercial paint may contain lead
Plastic manufacturers	Materials made may contain lead
Plumbers and pipe fitters	Pipes may contain lead
Police officers	Ammunition contains lead
Radiator repairers	Radiators may contain lead
Recyclers of metal, electronics, and batteries	May contain lead
Rubber product manufacturers	Process contains lead
Shipbuilders	Materials used may include lead
Solid waste incinerator operators	Waste may contain lead
Steel welder	Galvanized steel is coated in part with lead

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## RESOURCES

- Oregon Lead Poisoning Prevention Program: [www.healthoregon.org/lead](http://www.healthoregon.org/lead)
- CDC Guidelines for Identification and Management of Lead Exposure: [www.cdc.gov/nceh/lead](http://www.cdc.gov/nceh/lead)
- Northwest Pediatric Environmental Health Specialty Unit (PEHSU) for written guidance and clinician consultation: <http://depts.washington.edu/pehsu/index> or 1-877-KID-CHEM.
- CDC Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women: <http://www.cdc.gov/nceh/lead/publications/leadandpregnancy2010.pdf>

## UPDATE LOG

July 2011: Updated to reflect Oregon Health Authority. Updated to reflect change in adult surveillance case definition.

June 2013: Updated to reflect new CDC guidance on childhood lead reference value. Updated with additional information from CDC's guidance for lead exposure in pregnant and lactating women.

May 2016: Updated to reflect Oregon Health Authority adoption of CDC childhood lead reference value and public health action level. Updated to reflect case management guidelines for children and pregnant and lactating women.

February 2018: Updated to reflect change in adult surveillance and case definition. Updated CDC list of lead-related industries and occupations Tables 6A and 6B.

October 2018: Updated to reflect changes in environmental sampling protocols and communication of case management records.