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MANAGING INDIVIDUAL EXPOSURE TO LEAD IN AUSTRALIA — A GUIDE FOR HEALTH PRACTITIONERS

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WORKING TO BUILD A HEALTHY AUSTRALIA

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Summary

Lead exposure in Australia

- Exposure to lead in Australia has dropped significantly over recent decades as a result of measures restricting the use of lead in paint, petrol and consumer goods. As a result, the average blood lead level in Australia is estimated to be less than 5 micrograms per decilitre.
- NHMRC recommends that if a person has a blood lead level greater than **5 micrograms per decilitre**, the source of exposure should be investigated and reduced, particularly if the person is a child or pregnant woman.
- Investigating the source of exposure where blood lead levels are greater than 5 micrograms per decilitre will reduce the risk of harm not only to the individual, but others in the community, including those who may be more vulnerable to the effects of lead (such as children).

Health effects of lead

- The health effects due to exposure to lead vary greatly between individuals and depend on a variety of factors such as a person's age, the amount of lead a person is exposed to and for how long, and if they have other health conditions.
- The possibility of health effects from lead in the body is higher for children and babies (including unborn babies) than for adults, because their bodies are smaller and their brains are developing rapidly. Lead toxicity affects a range of molecular processes, in part due to its ability to inhibit and mimic the actions of calcium. This impacts on many organs and systems within the body.
- There is an association between blood lead levels of 5 to 10 micrograms per decilitre and adverse cognitive effects (reduced Intelligence Quotient (IQ) and academic achievement) and behavioural problems (effects on attention, impulsivity and hyperactivity) in children. However, it is unclear whether this association is causal.
- For blood lead levels greater than 10 micrograms per decilitre there are well established adverse effects on the body's digestive, cardiovascular, renal, reproductive and neurological functions.

Testing blood lead levels

- Measurement of blood lead should be considered when symptoms or health effects associated with lead are present and/or a source of lead exposure is suspected.
- Testing of asymptomatic children should be conducted based on the individual's risk profile (eg. life stage, exposure of other household members, local environment and current health status).
- A blood lead test is considered the most reliable biomarker for general clinical use. Results tend to reflect more recent exposure but do not necessarily provide information about stored lead in the body.
- Other types of blood tests (e.g. plasma lead test or erythrocyte protoporphyrin test) and tests of bone, teeth, sweat, nails or hair are not recommended for clinical use.

Management of individuals

- Health practitioners should be aware of the requirements in their state or territory for notification of blood lead levels to public health authorities.
- Collaboration between primary health practitioners and state and territory environmental health agencies is recommended to identify and manage exposure.
- Management approaches are based on individual blood levels and the person's overall health and social environment.
- Testing family members, and others suspected of being exposed to the lead source should be considered as part of the management plan.

Investigating the source of exposure

- The first step to reducing elevated blood lead levels in individuals is to identify the source/s of exposure. A planned, logical process should be followed to identify lead hazards, and the presence of multiple lead sources should not be ruled out or overlooked.
- Once the source has been identified, an exposure assessment should be undertaken to identify the extent and pathways of exposure.

Interventions for reducing elevated blood lead levels

- Management strategies should focus on breaking the exposure pathway. Addressing or removing the source of lead is the most effective intervention, provided it can be successfully applied. This should take place before attempts are made to change behaviour (e.g. through access restriction and education).
- Substituting lead-containing products with lead-free products will have an immediate beneficial effect. Remediation of widespread diffuse sources of lead will require consultation with the local, state or territory health and environmental protection authorities.

About this Guide

Managing Individual Exposure to Lead in Australia – A Guide for Health Practitioners (the Guide) provides health practitioners, including clinicians and environmental health officers, and health agencies with general information to assist in the management of individuals with elevated blood lead levels.

The Guide provides information on:

- The risk of lead exposure in the community and the potential for harm in an individual
- Indications for testing individuals for exposure to lead
- Management of individuals who have elevated blood lead levels
- Environmental investigations for lead sources and interventions for reducing and preventing lead exposure.

The Guide was developed following a comprehensive independent review of the health effects of lead conducted by the NHMRC. The findings of this review were used to develop NHMRC's Statement and Information Paper: *Evidence on the Effects of Lead on Human Health (May 2015).*

The Guide was developed in consultation with the NHMRC's Lead Working Committee and with state and territory health authorities through the Environmental Health Standing Committee.

The Guide provides the basic principles on the detection and management of exposure from which state and territory health departments can develop specific advice.

The Guide is not intended to provide guidance to health practitioners working in communities where lead is endemic (such as lead mining and smelting communities). In these areas, health authorities provide information and run programs tailored to the needs of the local community.

The Guide does not constitute a clinical practice guideline.

Context

Lead and lead compounds are known to be toxic to human health. In the past, recommendations limiting exposure to lead were made with regard to acute symptoms of lead exposure observed in adults. Since the 1980's the focus has shifted to limiting lead exposure in children to protect against effects on children's developing brains and nervous systems. The current evidence suggests that even low levels of exposure may result in subtle health effects across the population; however these may not necessarily be discernible in an individual.

Exposure to lead in Australia has reduced significantly in recent years. Initiatives which have restricted the addition of lead to paint, petrol and other consumer goods have meant that the average blood lead level is now a lot lower than in the past. While overall community exposure to lead has reduced, there are still a number of sources of lead in the environment, and continuing effort is required to minimise exposure. The focus of public health measures for managing lead exposure in Australia has therefore shifted from interventions that change the whole community's risk of exposure, to controlling the risk of individual exposure from particular sources. The ability for health practitioners to identify when to test for lead exposure and what to do if a person has an elevated blood lead level remains an important component of Australia's public health response to managing lead in the community. This Guide contains practical information applicable to the Australian situation for use by health agencies and practitioners for managing lead exposure in individuals.

1. How do people become exposed to lead?

1.1 Background level of exposure in Australia

Lead occurs in the environment as a wide variety of compounds and remains permanently in dust and soil until it is physically removed. As a result of its previous use in manufacturing, lead can still be found in small amounts throughout the Australian environment. Trace amounts of lead can be found in food, drinking water, air, dust, soil, and consumer products. Exposures to these sources of lead are generally unavoidable and make up the average 'background' level of exposure in Australia.

Because most people are exposed to small amounts of lead every day, most Australians will have some level of lead in their blood when a blood lead test is performed. The average 'background' blood lead level in Australia is estimated to be less than 5 micrograms per decilitre. Today, a blood lead level greater than 5 micrograms per decilitre indicates a person has been, or continues to be, exposed to a source of lead that is additional to the background levels of exposure found in most places.

1.2 Routes of exposure

Lead is not readily absorbed through the skin. People absorb lead into the body by breathing lead-contaminated air or swallowing lead-contaminated particles. The proportion of lead that is absorbed depends on several factors including the solubility of the lead contaminant, the size of the lead particles and the person's age, sex, and diet. In pregnant women, lead in the bloodstream can cross the placenta into the foetal blood.

Small children are more likely than adults to swallow small amounts of lead, because they put things in their mouths, touch dusty surfaces indoors and outdoors, and touch their mouths more often. Children also absorb a higher proportion of lead than adults as their bodies are growing and changing constantly.

Once in the lungs or gut, lead is absorbed into the bloodstream and is distributed to the liver, kidneys, lungs, brain, spleen, muscles, and heart, and can be stored in bones and teeth. Lead that has been stored in bones and teeth can be released many years after exposure. This tends to occur during times of calcium mobilisation, which includes growth spurts, pregnancy, breastfeeding, menopause, prolonged bed rest or osteoporosis.

Over a number of years most of the lead in the blood is removed from the body by the kidneys in urine, and some is removed by the liver in faeces.

1.3 Common sources of lead exposure in Australia

Workplaces involving the use of lead compounds are a common source of additional lead exposure in Australia. Workplace health and safety standards require an employer to notify an employee if they are undertaking lead risk work. Workplace blood lead removal levels require the removal of an employee from lead risk work if their blood lead level exceeds a particular level (see www.safeworkaustralia.gov.au).

In some cases lead based paints in older residential areas are the source of lead in the environment. Peeling or damaged paint or renovation of older houses and buildings can create very fine particles of lead in dust and visible lead flakes that may be inhaled or consumed by people living or working inside or nearby the property. Houses built before 1980 are likely to contain lead based paint. Houses built prior to 1965 may have used paint that contains as much as 50 per cent lead[1]. The Commonwealth Department of the Environment's Lead Alert: The six step guide to painting your home contains practical steps for reducing the risk of exposure to lead based paint: https://www.environment.gov.au/protection/publications/lead-alert-six-step-guide-painting-your-home

In some communities with a history of high traffic flow, roadside soil may still contain lead deposited from traffic fumes prior to the removal of lead from petrol. In these areas care should be taken to wash hands after coming into contact with dirt and soil, particularly in children.

Lead exposure also needs to be considered when people participate in hobbies such as restoring boats, cars and furniture, glazing and firing pottery, soldering, casting lead, and recycling objects containing lead.

Some imported toys, jewellery, cosmetics and complementary medicines have also been found to be contaminated with lead.

A list of lead sources in Australia is provided at Appendix 1.

1 Lead test kits can be purchased from hardware stores for testing for the presence of lead in paint and soil.

2. What are the health effects of lead exposure?

Health effects resulting from exposure to lead depend on a person's age, the amount of lead a person is exposed to and for how long, and if they have other health conditions.

Children are at the greatest risk of developing health effects as a result of lead exposure because they absorb a higher proportion of ingested lead than adults, they are more sensitive to the effects of lead because their brains and nervous system are developing rapidly and they can be exposed to greater amounts of lead through pica like behaviours, crawling and touching dusty surfaces, contact with contaminated soil and mouthing objects contaminated with lead.

Blood lead levels at which people exhibit symptoms vary greatly between individuals. It is possible for people with blood lead levels of 40 micrograms per decilitre or more not to exhibit noticeable health effects.

For a complete discussion on the health effects of lead see *NHMRC: Information Paper: Evidence on the Effects of Lead on Human Health*.

2.1 Blood lead levels between 5 micrograms and 10 micrograms per decilitre

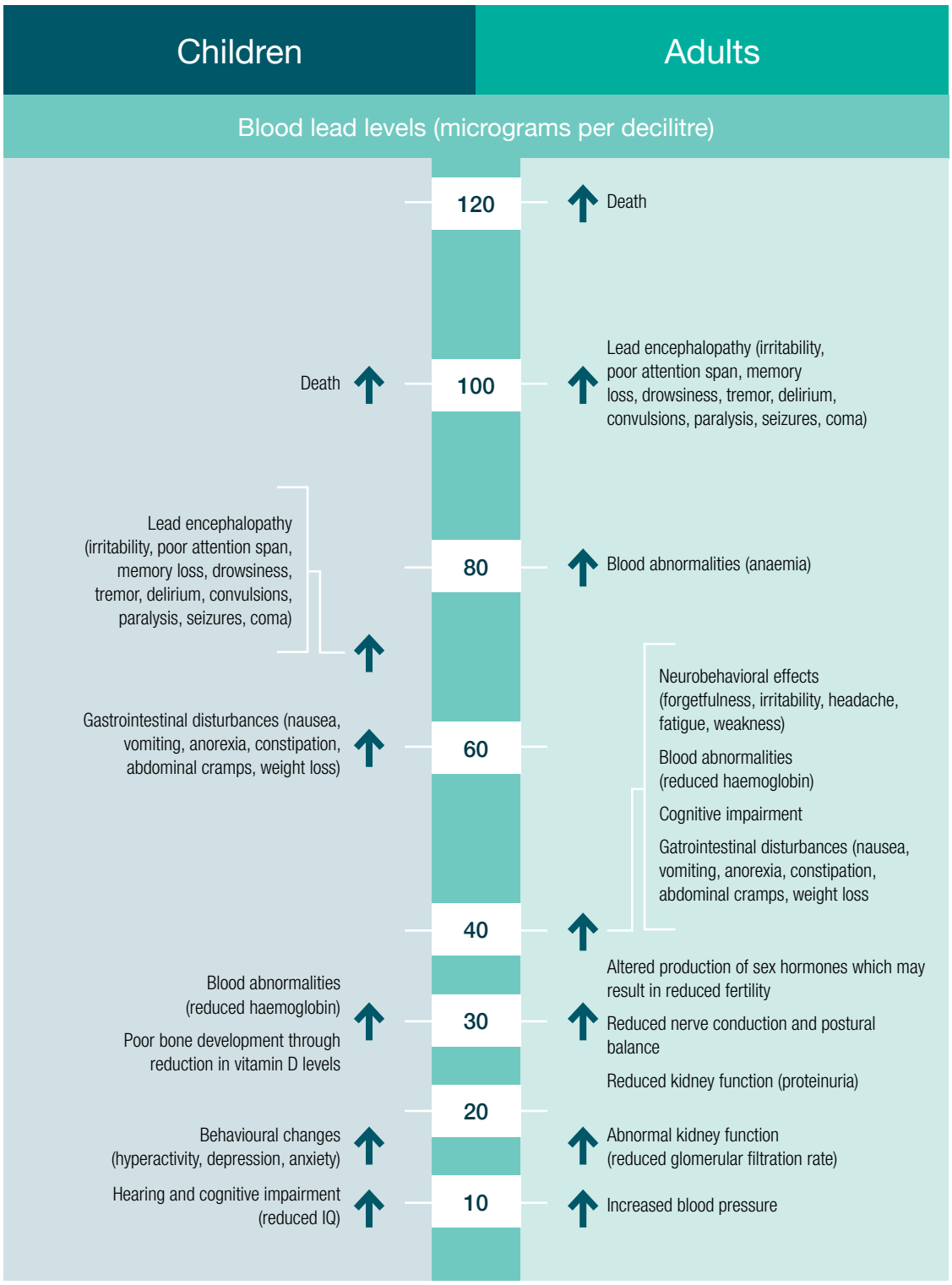
The effects of blood lead levels less than 10 micrograms per decilitre were found to be less clear, and are unlikely to result in noticeable health effects in an individual.

However, in some population groups it may be associated with adverse cognitive effects, adverse behavioural effects, delayed sexual maturation or puberty in children, and increased blood pressure and increased risk of hypertension in adults and pregnant women. Even in these studies causal association between lead and observed health effects were not established.

2.2 Blood lead levels greater than 10 micrograms per decilitre

It is well established that blood lead levels greater than 10 micrograms per decilitre can have harmful effects on many organs and bodily functions. Effects such as increased blood pressure, abnormally low haemoglobin, abnormal kidney function, long-term kidney damage and abnormal brain function have been observed at blood lead levels between 10 micrograms and 60 micrograms per decilitre in adults and children. Encephalopathy, and death in some cases, can occur at blood lead levels of 100-120 micrograms per decilitre in adults and 70-100 micrograms per decilitre in children (Figure 1).

Figure 1: Summary of health effects of lead exposure above 10 micrograms per decilitre



Upward arrows indicate the lowest blood lead level at which the health effects were reported in individuals in various studies. Blood lead levels at which people exhibit symptoms vary greatly between individuals. It is possible for people with blood lead levels of 40 micrograms per decilitre or more not to exhibit noticeable health effects.

3. When is it appropriate to do a blood lead test?

A blood lead test should be arranged if there is a particular reason to suspect that a person has been exposed to lead, for example:

- they have been involved in activities that may result in them swallowing, inhaling or touching lead or a substance that is contaminated with lead, see Appendix 1; or
- they have unexplained health problems or behavioural issues that could be due to lead; or
- someone else in the person's household has had a blood lead test that showed a level exceeding 5 micrograms per decilitre.

3.1 Physical signs and symptoms present

If symptoms or physical findings of lead exposure are present, they are often difficult to differentiate, as they are generally nonspecific and quite common. These symptoms may include constipation, abdominal pain (colic), anaemia, headache, fatigue, restless legs and arms, tingling or prickling sensations in skin, myalgia and arthralgia, anorexia, sleep disturbance and difficulty concentrating. Measurement of blood lead should be considered when these symptoms are present and a source of lead exposure is plausible.

Measurement of blood lead should also be considered in the evaluation of acutely ill children presenting with unexplained severe colic, seizure or coma and in the differential diagnosis of consistent constitutional symptoms (such as persistent headache, myalgia, fatigue) and anaemia.

3.2 Testing in children

A lack of symptoms does not mean that a person's blood lead level is within the normal range. Health practitioners should remain alert to the potential for unrecognised lead exposures, particularly among children and women of child-bearing age. However, a community screening program of children's blood lead levels is not recommended, except in communities where exposure is widespread (see *NHMRC Information Paper: Evidence on the Effects of Lead on Human Health*). However, testing of asymptomatic children should be based on the individual's risk of exposure to lead.

The potential for lead exposure is dependent on the child's environment and changes with a child's developmental progress and behavioural patterns. Behaviours such as hand-mouth behaviour, ingestion of non-food substances or objects (pica), increasing mobility and ability to reach potentially contaminated surfaces such as windowsills increase the child's risk of exposure. There is generally no need for testing infants less than 6 months of age, if the mother has a blood lead level of 5 micrograms per decilitre or less.

Factors that may raise the index of suspicion to prompt a blood lead test in children include:

- the child lives in, or frequently visits older dilapidated housing with flaking, peeling or chalking paint
- the child is present during renovations of houses built before 1980
- the child lives with a person involved in lead-related work or who has lead hobbies

- the child displays pica behaviour and a lead source is identified
- other members of the child's family or a play mate has an elevated blood lead level
- there is a reason to believe the child has swallowed a lead containing object ie sinker, weight or lead shot pellet.

In some circumstances, even if lead toxicity is not thought to be the main contributor to a clinical issue (eg a child with developmental delay), it may be appropriate to recommend testing to help rule out excessive lead exposure as a preventable contributing factor.

Routinely obtaining an environmental history as well as family occupational history is important for all children and is encouraged in a paediatric context, to help identify any potential exposures of concern and provide families with lead-prevention counselling. This approach enables a more targeted assessment of risks and informed decisions can be made by health practitioners regarding the need for blood lead testing.

3.3 How to test for lead exposure

The blood lead test is the standard, accepted and most accurate method for testing individuals and communities for recent exposure to lead in Australia. It involves collecting a blood sample from a vein (venous blood sample) or finger prick (capillary sample). Venous blood is generally preferred because it is less prone to contamination from lead on the skin.

Other methods of testing for lead include other types of blood tests (e.g. plasma lead test or erythrocyte protoporphyrin test) and tests of bone, teeth, sweat, nails or hair. These testing methods have not been standardised for medical application or been used in the same way as blood lead levels used to measure associations between exposure to lead and health effects.

4. What does a blood lead test show?

A blood lead test generally detects lead that the person has breathed or swallowed within a few weeks or months of testing. If a person has been exposed to a steady, small amount of lead (rather than a larger amount from an unusual source), blood lead is a reliable indicator of their level of exposure, especially if several measurements are available. However, if a person has been exposed to a large amount of lead, a blood lead test will not indicate the total amount of lead in a person's body. This is because the lead circulating in the body is excreted by the kidneys or liver (in urine and faeces) and the remainder is stored in bone. This stored lead may be released back into the blood during pregnancy, lactation, menopause, osteoporosis, periods of growth and periods of extended bed-rest.

If a person has a blood lead level greater than 5 micrograms per decilitre, there are several possible reasons:

- they may have recently been exposed to lead in a single incident such as accidently swallowing some lead dust or lead containing paint
- they may have been exposed to higher-than-average amounts of lead over time such as from lead dust exposed during home renovation or redecoration
- lead that had previously accumulated in their bones is being released into their bloodstream

Note: In the majority of cases, the blood lead result is unlikely to be diagnostic or prove that a particular clinical problem has been caused by lead exposure (eg where there is concern about a neurodevelopmental delay in a child). As increased blood lead level in children with developmental and behavioural problems is likely to contribute to, rather than solely cause these clinical problems it is essential that management of the child's situation includes clinical, developmental and educational intervention as well as strategies to reduce ongoing lead exposure.

4.1 Accuracy of blood lead testing

As with any laboratory test, blood lead test results are not perfectly accurate and variation in accuracy between different testing laboratories can occur even when following strict protocols. There is a small margin of error, ± 2 micrograms per decilitre, which needs to be considered when interpreting results and is particularly significant when the concentration of lead is less than 10 micrograms per decilitre (e.g. if an individual's blood test result is 5 micrograms per decilitre, this would indicate the actual blood level is somewhere between 4 and 6 micrograms per decilitre). As such the blood lead test results act to confirm if exposure is above the expected background level and to what degree.

5. Managing blood lead levels

In some states and territories, legislation requires pathology laboratories (or medical practitioners) that conduct blood lead testing to notify public health authorities if a person's blood lead level is found to be above a specified level. In some instances, health authorities will follow up cases of elevated blood lead levels to assist with identifying sources of lead exposure in the person's environment. A summary of notification requirements is provided in Section 8.

5.1 Management framework

Collaboration between primary health practitioners and state and territory environmental health agencies is often required for managing elevated blood lead levels in individuals. In non-lead endemic environments, a blood lead level greater than 5 micrograms per decilitre should trigger intervention to identify and reduce exposure. Engagement with state and territory health authorities is appropriate where blood lead levels are greater than 10 micrograms per decilitre.

Intervention strategies for the management of elevated blood lead levels should be proportionate to the health risk and graduated depending on the level of exposure. The type of advice and management strategies utilised to reduce exposure should be considered in the context of the person's overall health and social environment.

Testing of others who may be exposed to the same lead source should occur as part of the management framework.

The following table provides a summary of the likely health effects and appropriate responses for managing blood lead levels in individuals.

5 micrograms per decilitre or less

- This blood lead level range indicates that a person's exposure to lead is within normal background levels of exposure in Australia.
- Most people will have some level of lead in their blood as a result of usual background exposure.
- Investigation into the source of exposure is not required.

Note: Within this blood lead level range it may be worthwhile considering investigating the source of lead exposure in pregnant women in the first trimester with a blood lead level greater than 4 micrograms per decilitre. A child's blood lead level may increase shortly after birth (particularly when the child begins to crawl). Measurement error and mobilisation of bone lead stores should be considered when interpreting blood lead test results (see **Section 4**).

Between 5 and 10 micrograms per decilitre

- This blood lead level range indicates that a person has been, or continues to be, exposed to an additional and potentially modifiable source of lead.
- The source of lead exposure should be investigated and reduced, particularly if the person is a child or pregnant woman.
- Individuals are extremely unlikely to display noticeable signs or symptoms as a result of lead exposure, however associations with reduced cognitive function and behavioural problems have been observed in children within population studies. (Blood lead levels in this range are unlikely to be the primary cause of impaired development/cognitive function, nor major behavioural problems, however the risk of these health effects occurring increases as blood lead levels rise.)
- A detailed patient history may be required to identify possible sources of lead in the person's environment.
- Advice on behavioural strategies and environmental abatement strategies should be provided (see **Section 7**).
- A follow up blood lead test should be undertaken at six months or earlier if clinically indicated, after the source of exposure has been remediated.
- Consider testing other members of the household or those suspected of being exposed to the lead source.

Between 10 and 20 micrograms per decilitre

- This blood lead level range indicates that a person has been, or continues to be, exposed to an additional source of lead that may result in health effects, particularly in children.
- In children, impaired cognitive function (reductions in IQ), behavioural changes (such as hyperactivity) and impaired hearing may occur. In adults, reductions in kidney function and increases in blood pressure may occur.
- A detailed patient history should be obtained to identify possible sources of lead in the person's environment.
- Advice on behavioural strategies and environmental abatement strategies should be provided (see **Section 7**).
- A follow up blood lead test should be undertaken at six months or earlier if clinically indicated, after the source of exposure has been remediated.
- Management of exposure is conducted in consultation with state and territory health authorities.
- Consider testing other members of the household or those suspected of being exposed to the lead source.

20–44 micrograms per decilitre

- This blood lead level range indicates that a person has been, or continues to be exposed to an additional source of lead that may result in noticeable health effects, particularly in children.
- Patients may present with acute symptoms of lead exposure, such as gastrointestinal disturbances (e.g. nausea, vomiting, constipation and abdominal pain) and neurobehavioural effects (e.g. forgetfulness, irritability, headache and fatigue) in adults and behavioural changes and reduced haemoglobin in children.
- Referral to a paediatrician for clinical evaluation and management should be considered if a child has a blood lead level greater than 20 micrograms per decilitre.
- Environmental intervention including exposure evaluation, environmental investigation, risk assessment and management of the exposure source should be undertaken.
- Management of exposure is conducted in consultation with state and territory health authorities.
- Consider testing other members of the household or those suspected of being exposed to the lead source.

45–69 micrograms per decilitre

- This blood lead level range indicates that a person has been exposed to a harmful level of lead that may result in acute symptoms of lead exposure.
- Acute symptoms of lead exposure may include gastrointestinal disturbances (eg. nausea, vomiting, constipation and abdominal pain), neurobehavioral effects (eg. forgetfulness, irritability, headache and fatigue) pallor and muscle weakness.
- Referral to a paediatrician for clinical evaluation and management is recommended.
- Provide coordination of care (case management) within 48 hours.
- Chelation therapy is recommended for children with a blood lead level of 45 micrograms per decilitre or more, or where severe signs or symptoms of high exposure to lead such as encephalopathy are present.
- Only specialist clinicians should prescribe and oversee chelation therapy in people who have been exposed to lead.
- Environmental intervention including exposure evaluation, environmental investigation, risk assessment and management of the exposure source should be undertaken.
- Management of exposure is conducted in consultation with state and territory health authorities.
- Consider testing other members of the household or those suspected of being exposed to the lead source.

Note: Chelation therapy is not recommended in adults unless the person has a blood lead level greater than 70 micrograms per decilitre or where severe signs or symptoms of high lead exposure such as encephalopathy are present.

≥70 micrograms per decilitre (or in case of encephalopathy)

- This is a medical emergency.
- Provide diagnostic testing immediately as an emergency lab test**.**
- Hospitalise and immediately begin chelation therapy based on clinical appropriateness.

6. Investigating the source of exposure

A blood lead level greater than 5 micrograms per decilitre indicates that a person has been, or continues to be exposed to an additional and potentially modifiable source of lead. The first step in reducing a person's blood lead level is to identify the source/s of exposure.

A planned, logical process should be followed to identify lead hazards in the person's environment. The possibility of multiple exposure sources should not be ruled out or overlooked during the hazard identification process. Advice on identifying the source of lead can be obtained from the local public health or environmental health agency.

Appendix 1 provides a list of possible lead sources in Australia.

6.1 Environmental sampling

Targeted environmental sampling is more efficient than scattered approaches. However, environmental sampling is expensive and may be misleading. Therefore identifying and characterising those potential sources that can be ruled out is recommended as the first step.

There are a range of national and state-based standards including those for air, soil, drinking water and paints. Paint can be tested (as present/absent) using test kits available from hardware stores or by analytical laboratories, however these may be inaccurate, especially where low concentrations of lead are present or where the reagents have aged.

6.2 Follow-up testing

Once the source of exposure has been identified and removed (or remediated) (see Section 7) a follow-up blood lead test should be undertaken to confirm exposure has reduced. For example, in instances where the source of exposure was identified to be from renovation of an older home, follow up testing should be conducted following the complete clean-up and removal of lead dust within the home.

Generally, follow up testing should be undertaken at six months or earlier if clinically indicated, after the source of exposure has been remediated. Further follow up testing of children should be considered based on their risk of exposure.

If a follow up blood lead test does not show a reduction in the person's blood lead level, further investigation into the source of exposure should be undertaken. State and territory health authorities can assist with identifying sources of lead in the person's environment. Conversely if results of follow up tests fall below the notification limit, state and territory health authorities should be notified as well.

A confirmatory follow-up blood lead test should be performed on a venous blood sample if a capillary sample shows an elevated blood lead level.

7. General interventions for reducing exposure

Removal of the lead source is the preferred method for reducing exposure, although in some instances complete removal may not be possible or impractical. If the source of exposure cannot be removed, intervention should focus on exposure minimisation and behaviour modification. The following section provides general approaches to reducing lead exposure.

Separate the person(s) of concern from the source of lead

- Relocating the person (particularly if the person is a child) is recommended if there is a potential for exposure to lead. This is especially the case if home renovations are implicated, as it is difficult to seal one part of any home against transfer of dust during renovations.
- Prior to reoccupation, the house should be thoroughly cleaned with a HEPA-filtered vacuum cleaner and wet mopped. Replacement of carpet should be considered as complete removal of lead from old carpets may not be possible.
- A specialist cleaning service should be considered for the final clean. Ensure children are not present during the cleaning due to the potential to create dust. Appropriate personal protective equipment (PPE) must always be worn during cleaning.

Isolate or reduce the lead source or restrict access to the source of lead

- Lead-related hobbies (e.g. lead lighting, renovating vehicles, engine repair work or restoring old boats, cars and furniture) should be carried out in a child-restricted area (e.g. shed). Clothes worn during these activities should be kept separate from other clothes, and not worn in the general living areas of the home. Contaminated clothes should not be washed with the family washing.
- Lead-contaminated surfaces can be covered with an impervious barrier if remediation is too difficult or likely to exacerbate the issue, especially if the remediation is to be undertaken by an inexperienced person.
- Children must be isolated from contaminated areas.
- Dust should be avoided — whether dealing with renovations, soil contamination, lead paint or hobbies. Any dust generated should be wet wiped/mopped regularly.

Control the hazard or exposure through appropriate education

- Home renovators should be familiar with the most appropriate manner to deal with lead paint (see https://www.environment.gov.au/protection/publications/lead-alert-six-step-guide-painting-your-home).
- Good hand hygiene is important for the whole family — parental modelling is central in engendering good habits in children. Note that hand hygiene must include drying the hands, as damp hands can be quickly re-contaminated in a lead-rich environment e.g. when paint has been stripped and the dust is still present.
- This aspect of hygiene differs from hygiene programs dealing with influenza and other infectious diseases. Alcohol-based hand gels will not alter the lead on the hands — the lead needs to be washed off the hands with running water and the hands dried with a clean towel.

Avoid lead-containing products especially if purchasing overseas

- Avoid certain products (see Appendix 1) purchased either over the internet or while overseas, unless from a reputable manufacturer, or from a country with similar levels of lead-related controls as Australia (e.g. Europe or North America).
- Substitution of products purchased overseas with products from Australia or other reputable suppliers may be required.

8. State and territory management

State/ territory	Notifier	Legislation	Notification level/ additional details
NSW	Laboratories on diagnosis	Public Health Act 1991	Venous blood lead level of ≥5µg/dL http://www.health.nsw.gov.au/Infectious/controlguideline/Pages/lead.aspx
Queensland	Laboratories on diagnosis	Public Health Regulations 2005	Notifiable ≥5µg/dL in any person http://disease-control.health.qld.gov.au/Condition/720/lead-exposure
Tasmania	Laboratories	Public Health Act 1997	Notifiable >5µg/dL http://www.dhhs.tas.gov.au/peh/communicable_diseases_prevention_unit/?a=53319
Victoria	Laboratories and medical practitioners on diagnosis	Public Health and Wellbeing Act 2008	Notifiable >5 µg/dL http://docs.health.vic.gov.au/docs/doc/Notifiable-Conditions-Form
Western Australia	Medical practitioners after diagnosis of lead poisoning	Health Act 1911 Health (Notification of Lead Poisoning) Regulations 1985	Notifiable ≥5µg/dL high-risk groups and ≥10 µg/dL for everyone else http://www.public.health.wa.gov.au/3/507/2/lead_poisoning_notifications.pm

Note: elevated blood lead levels are not currently notifiable conditions in South Australia, ACT and Northern Territory. Health authorities in these jurisdictions can follow up cases of lead exposure should a referral be made. The notification requirements change over time — local state/territory or regional public health authorities can advise on current requirements.

Appendix 1 Sources of lead

In the home

- Food or drink containers made with lead (lead crystal, pewter, ceramic cookware), especially if it was improperly fired (e.g. imported tagines)
- Imported toys containing lead or coated with lead-based paints
- Imported 'traditional' medicines
- Imported jewellery
- Imported cosmetics
- Old iron enamelled bathtubs, old pipes, solder and plumbing fittings
- Soil contaminated with lead (e.g. areas with high traffic flow where soil may contain lead from traffic fumes prior to removal of lead from petrol)
- Dust contaminated with lead (e.g. from renovation of old houses or buildings)
- Fishing sinkers
- Curtain weights

Activities

- Restoring homes, boats, cars and furniture that are coated with lead-based paints
- Glazing and firing pottery
- Soldering (radiators, stained glass, electronics)
- Casting lead (e.g. to make ammunition, fishing sinkers)
- Burning of lead-stabilised plastics or materials coated with lead-based paints
- Recycling of objects containing or coated with lead products (e.g. motor vehicle bodies, batteries, electronic equipment)
- Eating animals hunted using lead shot
- Exposure to lead dust at shooting ranges
- Lead mining and smelting, other industries that use lead

Other

- Some fuels (aviation gasoline for piston engines and some racing fuels) still contain lead

Workplaces

Refer to www.safeworkaustralia.gov.au

Appendix 2 Blood lead level conversions

Micrograms per decilitre (µg/dL)	Micromoles per litre (µmol/L)
1.0 µg/dL = 0.04826 µmol/L	1.0 µmol/L = 20.71 µg/dL
5 µg/dL	0.241 µmol/L
10 µg/dL	0.483 µmol/L
15 µg/dL	0.724 µmol/L
20 µg/dL	0.965 µmol/L
25 µg/dL	1.206 µmol/L
30 µg/dL	1.448 µmol/L
35 µg/dL	1.689 µmol/L
40 µg/dL	1.930 µmol/L
45 µg/dL	2.172 µmol/L
50 µg/dL	2.413 µmol/L
55 µg/dL	2.654 µmol/L
60 µg/dL	2.896 µmol/L
65 µg/dL	3.137 µmol/L
70 µg/dL	3.378 µmol/L

Convert from micrograms per decilitre (µg/dL) to micromoles per litre (µmol/L): Divide by 20.71

Convert from micromole per litre (µmol/L) to micrograms per decilitre (µg/dL): Multiply by 20.71