NT Health

Guideline

Due for review: 26/07/2029

Elevated blood lead level Clinical and Public Health

Contents

Applicability

This guideline applies to:

- All NT Health employees involved in clinical work, environmental health, policy and workplace safety.

This guideline is also used by health practitioners outside of NT Health.

Guideline statement

An elevated blood lead level (EBLL) is a reportable condition under the *Public and Environmental Health Act 2011*, *Gazette No. S53 26 July 2017*.

The guidelines draw from the National Health and Medical Research Council (NHMRC) managing individual exposure to lead in Australia – A guide for health practitioners.

This guideline provides additional information to support the clinical and public health response to EBLLs reported in the Northern Territory.

Policy suite

This guideline forms part of the following policy suite:

- Public and Environmental Health Act 2011
- Work Health and Safety Regulations 2011
- Lead Exposure Questionnaire Form
- Elevated Blood Lead Level Questionnaire in REDCap Work Instructions (Public Health Unit staff only)
- Notifiable Diseases Public Health Management Guide (Public Health Unit staff only).

Guideline details

This guideline supports implementation of the Guideline for the Reporting of Elevated Blood Lead Levels in the NT, as adopted by the Chief Health Officer (Gazette No S53) under the *Public and Environmental Health Act*.

1. Case definition

An elevated blood lead level (EBLL) is a blood lead level (BLL) greater than 5 micrograms per decilitre (mcg/dL) (equivalent to greater than 0.24 micromoles per litre (µmol/L).

All cases of EBLLs are reported to the Centre for Disease Control (CDC). If the notification relates to a follow up from a previous notified EBLL, the public health response can be modified according to the circumstances of the case.

2. Background

2.1 Lead in the environment

Lead is a metal with no known biological benefit to humans and can have harmful effects on the body. It occurs in the environment as a natural metal and a broad variety of compounds. A small amount of lead is widely present in foods and water supplies and some 'background' exposure for humans is near universal. In Australia, the amount of lead around us has greatly decreased due to the removal of lead from petrol, house paint and other goods.

Around the home, lead may be found in some houses built prior to 1974, particularly in the water from old lead pipes, old lead paint chips or dust, curtain weights, imported items such as food or drink containers, jewellery, traditional medicines and cosmetics, solder and brass plumbing fittings and soil contaminated with old lead car batteries. Activities and hobbies that may involve lead include: hunting or eating game such as magpie geese shot with lead shot, making or handling lead fishing sinkers or lead ammunition, home renovations, car/boat restoration, soldering, stained glass making and exposure to lead containing fuels (Avgas and some racing fuels). Leaded fuel for road vehicles was phased out in Australia in 2002. However, Avgas is a lead containing aviation fuel still commonly used for piston-engine airplanes. Avgas

sniffing cases with elevated BLL were reported at some remote communities in Arnhem Land in 2017, which received nationwide media attention. Elevated blood lead levels from volatile substance abuse with Avgas are reported in the NT.

Based on the Volatile Substance Abuse Prevention Act 2005, a Volatile Substance Management Area may be declared in a community by the Health Minister to control the possession, supply, use and storage of inhalants.

Lead is still used in many industries and the most common source of lead exposure in Australia is at workplaces involving the use of lead compounds. Workers can bring lead residues into their home on their work clothes, skin, hair and equipment after contact with lead.

Under the Work Health and Safety (WHS) Regulations Act 2011, health monitoring of lead risk workers is required before, during and after conducting lead risk work. Occupational clinics also test for elevated blood lead levels as an employment requirement. See section 5.1.1 for more information.

2.2 Effects of lead

Lead is absorbed through breathing lead-contaminated air or swallowing lead-contaminated particles. It is not readily absorbed through the skin. Inhalation or ingestion of lead at certain levels can produce neurodevelopmental dysfunction in children and a range of cardiovascular, renal, neurological, and haematological dysfunction in all people (Figure 1). Children and pregnant women are particularly vulnerable to the effects of lead, and iron deficiency is known to increase absorption of lead. There is no apparent safe threshold for the effect of lead exposure and some adverse effects from lead may not be reversible.

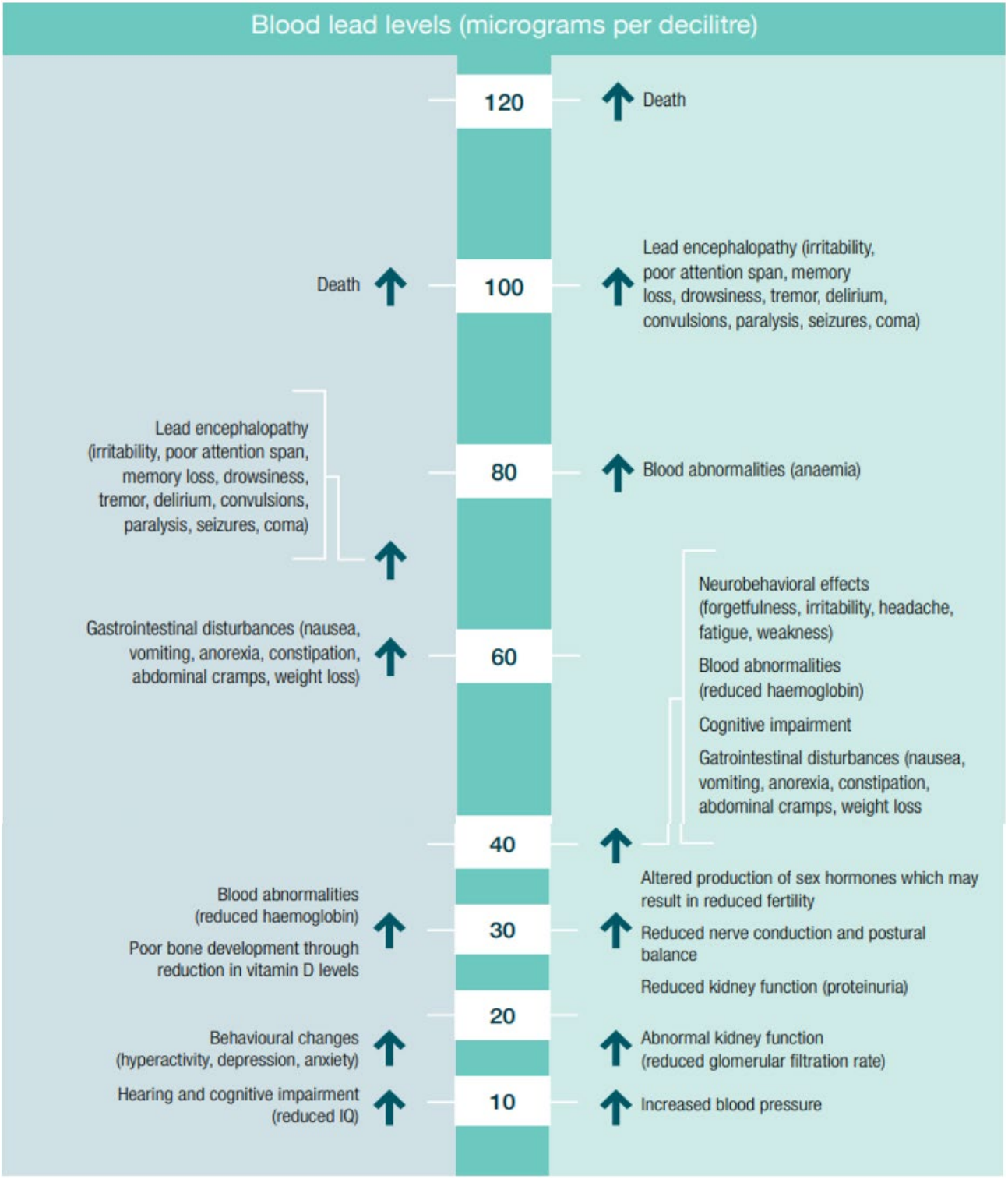
In lower levels, between 5-10 mcg/dL, associated harms may be clinically very subtle and difficult to ascribe to lead. In children, lead levels in the 10-20 mcg/dL range may manifest in hearing or cognitive impairment and behavioural changes (hyperactivity, depression, anxiety) or learning difficulties, with poor bone development and anaemia between 20-30 mcg/dL.

In adults, blood pressure can be raised and glomerular filtration rate can decrease at lead levels between 10-20 mcg/dL with fatigue, effects on mood and cognition, neuropathies, and further deterioration of renal function between 20-30 mcg/dL.

As levels go higher in both children and adults, further deterioration in neurological function (e.g. balance, fine motor coordination), cognition and behaviour occurs and gastrointestinal symptoms appear (abdominal pain, constipation and anorexia) as well as anaemia in adults.

Other effects include delayed puberty, fertility problems and increased risk of cancer. At very high levels (~70 mcg/dL in children and ~100 mcg/dL in adults) a severe encephalopathy may develop.

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.

Source: National Health and Medical Research Council. 2015 NHMRC Information Paper: *Evidence on the Effects of Lead on Human Health*. Canberra: National Health and Medical Research Council; 2015

2.3 Lead as a public health issue

Investigating the source of exposure where BLLs are >5mcg/dL 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.

A coordinated response between clinicians, public health practitioners and environmental health officers can enhance case management and public health protection through timely case detection, identification of lead sources, and enacting targeted interventions and education to remove lead sources.

Surveillance of EBLLs can reveal patterns and trends in lead exposures in the NT and can evaluate the effects of regional or Territory wide interventions. This is important as while the effects of lead exposure can be subtle within an individual, these effects may have a considerable impact when compounded at a population level (e.g. an average of 2 point drop in IQ across the population).

3. Reporting requirements

When a laboratory receives a result of a BLL >5mcg/dL, the laboratory will forward the result and relevant patient information to the CDC as required by the *Guideline for the reporting of elevated blood lead levels in the Northern Territory* under the *Public and Environmental Health Act 2011*. Only confirmed cases should be entered onto the CDC NT Notifiable Diseases System (NTNDS).

4. Testing blood lead levels

Testing a blood lead level should be considered when there is clinical suspicion of lead exposure either due to symptoms or behaviour and environmental factors that suggest of risk of lead exposure (Table1). BLLs represent lead exposure in recent weeks to months. It does not indicate the total amount stored in the body.

Send **two purple top (EDTA) tubes** (one for FBC, one for lead, as they go to different laboratories) and **one yellow top** (iron, UEC and LFTs).

4.1 Indications for testing

Table 1: Clinical, behavioural and environmental indications for testing

Clinical	Behavioural	Environmental
Developmental delay in children	Known to handle, play with, or mouth, lead containing products (lead pellets, lead sinkers, batteries).	Known or suspected environmental exposure (e.g. contaminated water, soil or food or case lives in dilapidated pre-1980s house with flaking paint or undergoing renovations)
Behavioural or cognitive problems		
Family member or other close individual has an elevated BLL	Sniffing lead containing petrol, Avgas or other lead containing substances	Working in 'lead-risk work' occupations/work See section 5.1.1

5. Response to elevated blood lead levels

5.1 Overview

The key points in the management of BLLs >5mcg/dL:

- most cases can be adequately managed through individual assessment to identify and remove likely lead exposures and provide targeted education to minimise further exposure
- medical intervention and hospitalisation is rarely required
- investigation and assessment of lead sources when required should be logically planned and proportional to the situation
- the most effective management strategy is to remove the source of lead. strategies to restrict access and education on personal behaviours are important supplementary measures
- the aim of monitoring and follow up is to ensure the effectiveness of management strategies in protecting individuals from lead harms
- Response time:
    - CDC to begin follow-up investigation within **3 business days** of receiving the notification.
    - Questionnaire to be returned by treating clinician to CDC:
        - Within **3 business days** of being received for **BLL ≥45mcg/dL**
        - Within **5 business days** for BLL **20-45mcg/dL**
        - Within **10 business days** for BLL **<20mcg/dL**
- response to EBLLs in children (<16 years) and pregnant women should be prioritised
- if volatile substance abuse (VSA) if suspected, refer to Appendix A for the Supplementary guidelines for the management and referral of people with elevated blood lead levels due to aviation gas (AVGAS) sniffing.

See the Testing and Management flow chart in Figure 3 for an overview of the steps in the response by different agencies.

The steps of management outlined here are guidelines only. From case to case, it may be reasonable to diverge from this approach. For example, when a common source is already identified for a household member. When in doubt, treating clinicians or those working with lead exposed individuals can contact their regional CDC Unit.

5.1.1 Occupational screening

Occupational screening refers to any testing of BLLs performed as part of a health surveillance program for employees who are about to commence or who are undertaking work in lead-risk jobs as per the Work Health and Safety (National Uniform Legislation) Act 2011 (WHS) and NT Worksafe guidelines (worksafe.nt.gov.au). The requesting medical practitioner informs the employer or business of the elevated lead level who then has legal responsibility through Work Health and Safety Regulations to carry out the appropriate actions. This includes repeating blood lead levels as required and notification to NT Worksafe should the worker be removed from the lead risk work.

If it is confirmed that lead blood levels exceed 10 mcg/dL (0.48 µmol/L) for female workers of reproductive capacity or 30 mcg/dL (1.44 µmol/L) for other workers, the worker must be removed from lead risk work and the workplace practices and controls should be immediately reviewed as this indicates current controls are not performing effectively (Work Health Safety Act 2011) . The business involved must notify NT WorkSafe as soon as practicable when a worker has been removed from lead risk work. The worker may then only return to lead risk work when the medical practitioner is satisfied that the worker is fit to return and the worker's blood lead level is less than: 5 mcg/dL (0.24 µmol/L) for females of reproductive capacity, or those who are pregnant or breastfeeding; 20 mcg/dL (0.97 µmol/L) for all others.

Any related queries should be directed to the relevant business or NT WorkSafe.

5.2 Clinical response (non-occupational)

If AVGAS is the suspected source, please refer to **Appendix A: Supplementary guidelines for management and referral of people with elevated blood lead levels due to aviation gas (Avgas) sniffing**

BLL >5mcg/dL to <10mcg/dL

For BLLs in this range, associated harms may be clinically very subtle and difficult to ascribe to lead.

Key steps by treating clinician:

1. Test and treat for iron deficiency
2. Complete Lead Exposure Questionnaire to determine source of lead*
3. Refer to paediatrician if child <16 years (via routine paediatric referral pathways)
4. Educate household on minimising lead exposure (see resources in section 5.5)
5. Strongly consider testing other household members or those suspected of being exposed to the lead source.

Follow up blood test: in 6 months

*The Lead Exposure Questionnaire and an online survey link will be emailed to the treating clinician by CDC.

If the source is unknown, the treating clinician (which may include an attending medical officer, nurse, allied health professional or Aboriginal Health Practioner) should go through the Questionnaire with the individual and/or family. This consult should be performed in a supportive environment with an interpreter present if indicated. Multidisciplinary input may be beneficial, including from a Community Development Officer or Social Worker.

The purpose of the Lead Exposure Questionnaire is to identify the source of lead exposure. These results should direct actions to remove the source of lead, and provide supporting education to individuals and families. When the lead source cannot be removed, strategies to restrict access and education to reduce exposure should be actioned. When the lead source is not identified, general education and advice may also be given.

Once the Questionnaire has been completed and received by the regional CDC Unit, management options can be discussed if advice is required. The regional CDC Unit may seek assistance from the NT CDC Surveillance Team in Darwin, Environmental Health, paediatrician and Volatile Substance Abuse Team if required.

Testing of household or other close contacts should be considered where there may be shared exposures. Other children or pregnant women should be prioritised.

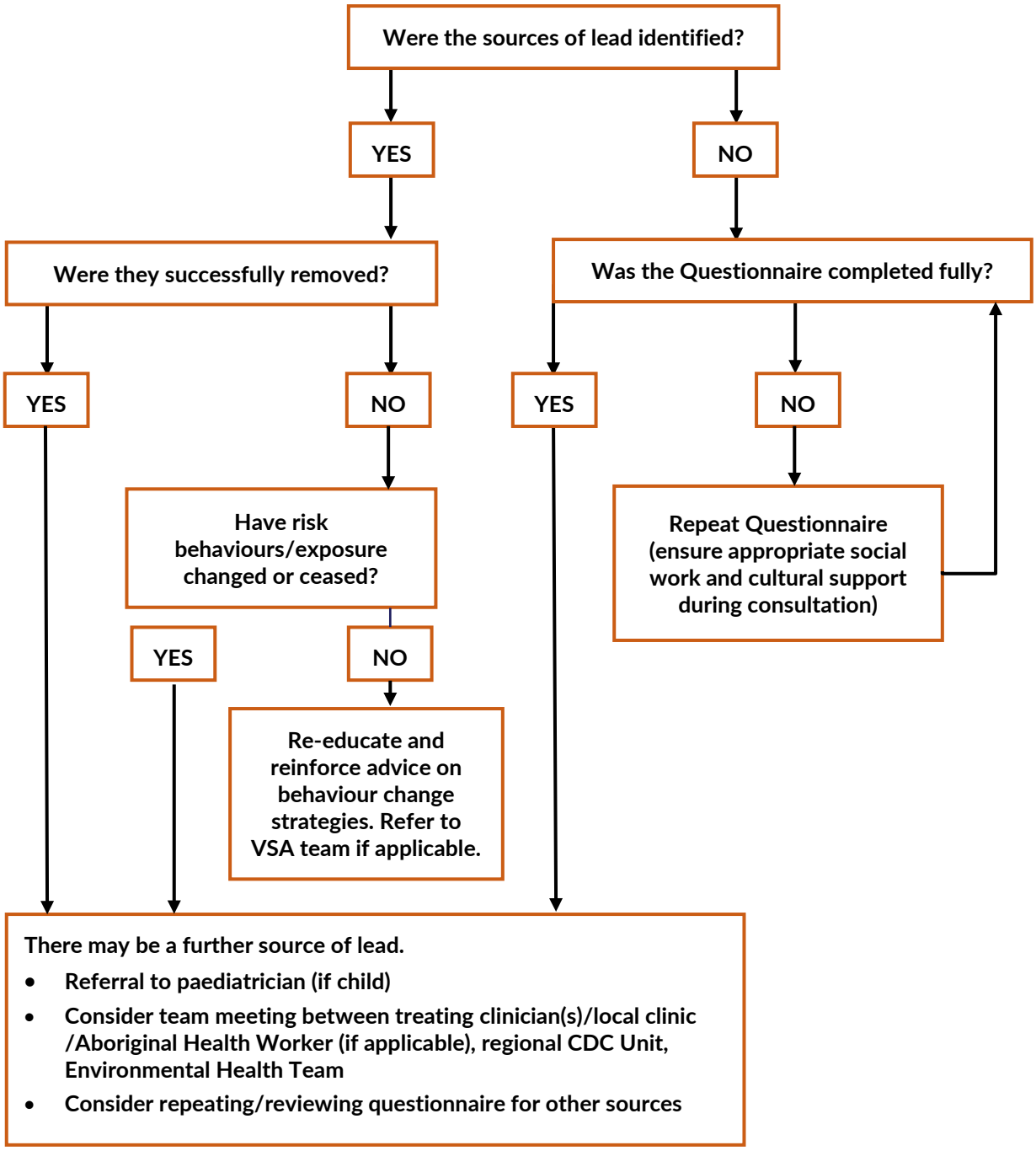
Follow-up of the case by the treating clinician should occur with the aims of:

- providing education to individuals/families on strategies to remove/restrict/reduce access to lead sources
- testing for iron deficiency where indicated and treat appropriately
- undertaking a clinical review and repeat BLL after 6 months to ensure the lead exposure has ended.

If the repeat BLL is at the same level or higher, the management steps can be revisited (Figure 2 on next page). Further advice to the individual/family may be needed, and the case can be discussed with the regional CDC Unit. If the case is a child, they should be referred to a pediatrician.

Whether the exposure has been short or long-term will influence the expected trajectory of BLL decline. If the source of exposure has been removed (or remediated) but a follow up blood lead test at 6 months does not show a reduction in the person's blood lead level, further investigation into the source of exposure should be undertaken.

Figure 2: Algorithm for when repeat testing results for >5mcg/dL to <10mcg/dL is *same or higher*



BLL 10mcg/dL to <20mcg/dL

BLLs in this level are likely to be causing harms which may or may not be associated with symptoms (Figure 1, page 5). First complete the Lead Exposure Questionnaire to notify or identify possible sources of lead (see section on BLL >5mcg/dL to <10mcg/dL) and submit to the CDC. The regional CDC Unit can provide advice around individual case management strategies.

Key steps by treating clinician:

1. Complete Lead Exposure Questionnaire*
2. Test and treat for iron deficiency
3. Refer to paediatrician if child <16 years (via routine paediatric referral pathways) and notify usual paediatrician or paediatric outreach nurse for the region via email. See section 5.6 for specialist outreach contact details
4. Educate household on minimising lead exposure (see resources in section 5.5)
5. Strongly consider testing other household members or those suspected of being exposed to the lead source
6. Follow up blood test: in 3 to 6 months (if BLL is same or higher, see Figure 2)

*The Lead Exposure Questionnaire and an online link will be emailed to the treating clinician by CDC.

BLL 20mcg/dL to <45mcg/dL

BLLs in this range may be having harmful effects on many organs and bodily functions, in both adults and children (Figure 1, page 5). Please complete the Lead Exposure Questionnaire to identify possible sources of lead (see section on BLL >5mcg/dL to <10mcg/dL). The regional CDC Unit can provide advice around individual case management strategies.

Key steps by treating clinician:

1. Complete Lead Exposure Questionnaire*
2. Test and treat for iron deficiency
3. Refer to paediatrician if child <16 years. Please call on-call paediatrician to discuss whether admission or urgent assessment is indicated.
4. Educate household on minimising lead exposure (see resources in section 5.5)
5. Strongly consider testing other household members or those suspected of being exposed to the lead source
6. Abdominal X-ray if source unknown (to assess for retained gastrointestinal lead)
7. Follow up blood test: in 1 month (if BLL is same or higher, see Figure 2)

*The Lead Exposure Questionnaire and an online link will be emailed to the treating clinician by CDC.

BLL ≥45mcg/dL

This level is harmful and acute symptoms may be present, for example gastrointestinal, cognitive or behavioural changes. Children with BLLs in this range **should be admitted to hospital**. Chelation is

generally indicated for children with BLLs ≥45mcg/dL and adults with BLLs ≥70mcg/dL, or where severe symptoms and signs are present (e.g. encephalopathy).

Key steps by treating clinician:

1. **Admission to hospital for children, consult a physician for adults**
2. Chelation considered with specialist input
3. Complete Lead Exposure Questionnaire*
4. Discuss case with regional CDC Unit
5. Test and treat for iron deficiency
6. Strongly consider testing other household members or those suspected of being exposed to the lead source
7. Follow up blood test: as determined through specialist consultation.

*The Lead Exposure Questionnaire and an online link will be emailed to the treating clinician by CDC.

The regional CDC unit will coordinate the required public health and environmental health investigation and management of the exposure.

5.3 Education resources for clinicians

Please see the Resources (section 5.5) for information on what education tools are available for practitioners.

5.4 Public Health Unit – Centre for Disease Control & Environmental Health

5.4.1 Notification of cases

The CDC maintains a database of all cases of elevated BLL in the NTNDS.

CDC receives laboratory results of elevated BLLs >5ug/dL automatically via fax or email. The regional CDC staff member who is responsible for the daily handling of notifiable disease results will ascertain whether the BLL was tested for occupational screening or not, and whether it represents a new or previously notified case. Both occupational and non-occupational elevated BLLs are notified and entered into the NTNDS. However, the CDC will only follow up non-occupational cases.

5.4.2 Case management coordination

The regional CDC unit is responsible for ensuring Lead Exposure Questionnaires are completed for cases where the lead source is unknown. The CDC can assist clinicians to interpret questionnaire results and advise on case management and educational tools and resources for individuals and families.

5.4.3 Public health intervention

Where an individual case or aggregate surveillance data of elevated BLLs indicate wider public health risks, the regional CDC unit will coordinate an appropriate public health response under outbreak management guidelines.

This may involve:

- convening an outbreak management team

- discussion of Questionnaire results and case details with the Environmental Health team to plan investigations (Appendix C)
- advising treating clinicians of 'at risk' populations who may require BLL testing
- Coordination with other Government departments and authorities where relevant. For example: Department of Industry, Tourism and Trade, Parks and Wildlife Commission, Department of Health-Primary Care, Aboriginal Community Controlled Health Organisations, Aboriginal Land Councils, Food Standards Australia New Zealand.

5.4.4 Environmental Health

Environmental Health Officers (EHOs) can offer advice and assistance to treating clinicians regarding removal/restriction/reduction strategies (Appendix C).

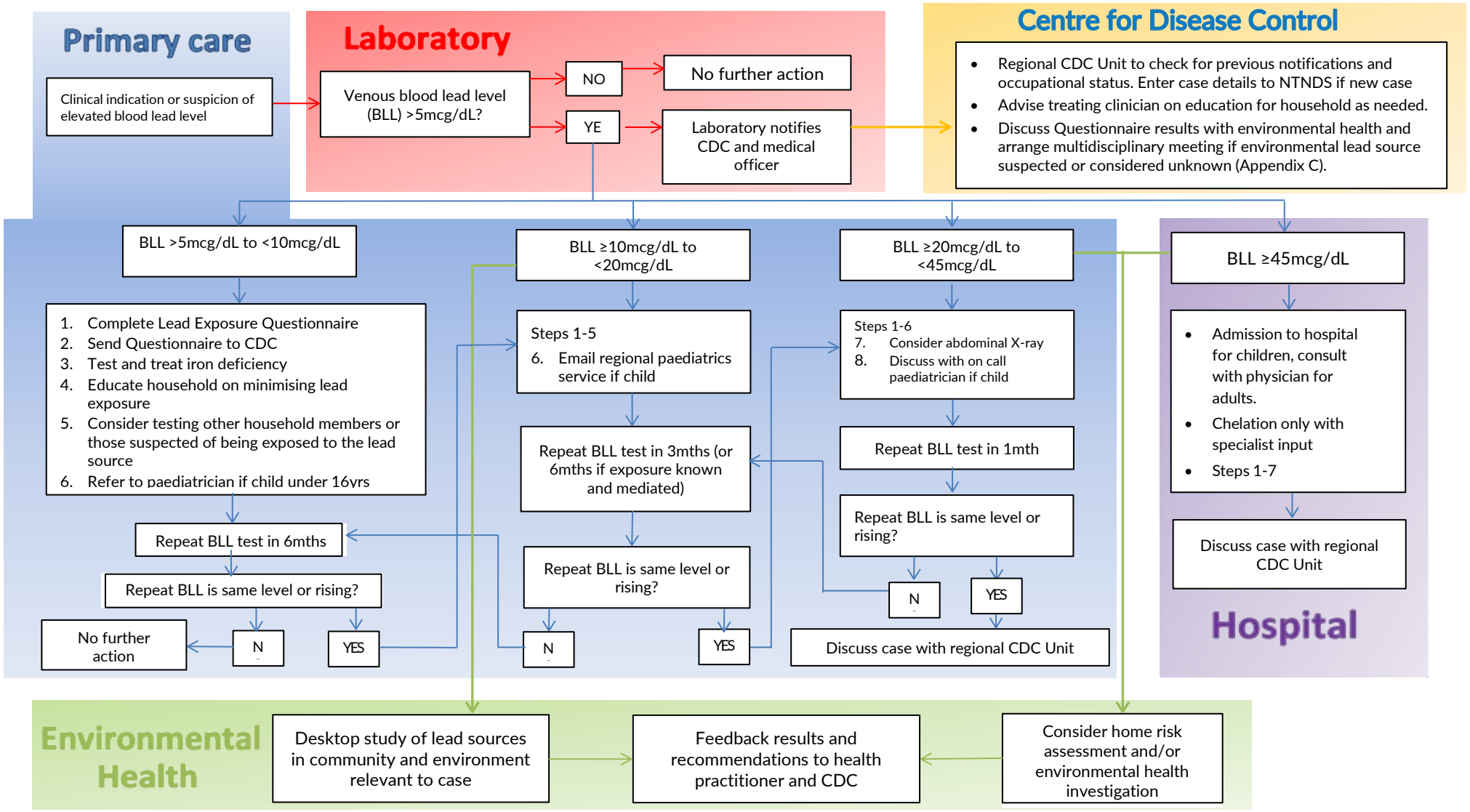
In cases where there is no identified source, or where there are wider public health concerns, EHOs may carry out environmental investigation, risk assessment and management of lead exposures in coordination with CDC and relevant authorities. Steps may include:

- a desktop study of known lead sources in the environment where a case resides, including checks with relevant NT government agencies on historical lead sources in the built environment and drinking water
- home risk assessment by phone or by visit using X-ray fluorescence (XRF) apparatus
- environmental testing with XRF apparatus and water sampling.

In coordination with CDC, EHOs provide information on results of testing and recommendations on remediation options to the treating clinician or relevant community authorities.

Repeat testing should be done in 3 months, or up to 6 months in cases where the exposure to lead is believed to have been effectively stopped (due to removal of source or effective behaviour change). If the repeat BLL is the same level or rising consider additional steps as per Figure 2 and/or discuss with the regional CDC Unit.

Figure 3: Testing and management flow chart for non-occupational elevated blood lead levels



5.5 Lead sources

Common lead sources (derived from NHMRC Guidelines)

Around the home:

- fishing sinkers
- curtain weights
- food or drink containers made with lead?
- imported toys or jewellery
- imported traditional medicines or cosmetics
- old pipes, solder and plumbing fittings
- soil contaminated with lead
- handling old car batteries
- pica (ingestion) of lead based paint chips/flakes or soils.

Activities:

- hunting with lead shot or eating game shot with lead shot
- casting lead to make fishing sinkers or ammunition
- handling or recycling lead containing objects such as car batteries, motor vehicle bodies, electronics
- soldering (e.g. in craftwork or workplace)
- exposure to lead dust at shooting ranges
- exposure to certain lead containing fuels (aviation fuels and some racing fuels)
- home renovations of pre-1970s houses
- restoring boats/cars.

5.6 Strategies to reduce lead exposure

Remove the lead source:

- remove lead containing products e.g. car batteries
- replace lead shot with non-toxic shot (steel, bismuth).

Restrict access and reduce exposure to lead source:

- don't handle lead shot directly
- relocate from old homes undergoing renovation, and thoroughly clean homes once renovations are complete and household is relocated
- don't allow children in areas where lead related activities take place (e.g. casting, soldering, mechanic works)

- use appropriate protective equipment if handing lead containing objects – separate set of clothing, use gloves
- avoid and safely remove dust (with wet mopping) associated with any lead related activity or object
- good hand hygiene using soap and water (alcohol based hand rubs do not remove lead)
- avoid buying products internationally that may contain lead
- restrict access to lead containing fuels
- reduce consumption of meats killed using lead shot.

Education tools and resources:

- NHMRC Information Paper: Evidence on the Effects of Lead on Human Health (a resource developed by the NHMRC containing practical information that people can consider to reduce their risk of lead exposure.

Other resources:

- Lead Exposure Questionnaire
- Elevated blood lead level | NT Health
- Hunting with lead shot and your health | NT Health Fact sheet
- Know the Facts | Lead | CDC
- Lead poisoning (who.int)
- Public health and notifiable diseases | NT Health
- Resource Guide - Chronic Conditions - Health Library at Northern Territory Department of Health

If you are having difficulty locating any of the resources, please contact the Centre for Disease Control.

5.7 Contact details

NT Regional Public Health Units – the Centre for Disease Control (CDC) contacts

Email: CDCSurveillance.Darwin@nt.gov.au

Location	Address	Phone	Fax
Darwin (Top End region) CDC	Ground Floor, Building 4 Royal Darwin Hospital Rocklands Drive Tiwi NT 0810	(08) 8922 8044 1800 008 002	(08) 8922 8310
Katherine (Big Rivers region) CDC	First floor, O'Keefe House Katherine Hospital Gorge Road Katherine NT 0850	(08) 8973 9049	(08) 8973 9048

Location	Address	Phone	Fax
Tennant Creek (Barkly region) CDC	Cnr Windley and Schmidt Street, Tennant Creek NT 0860	(08) 8962 4259	(08) 8962 4420
Alice Springs (Central Australia region) CDC	Ground Floor Eurilpa House, 25 Todd Street, Alice Springs NT 0871	(08) 8951 7540	(08) 8951 7900
Nhulunbuy (East Arnhem region) CDC	Mathew Flinders Way Nhulunbuy NT 0880	(08) 8987 0357	(08) 8987 0355

Environmental Health Branch

Phone: 08 8922 7377

Fax: 08 8922 7036

Email: envirohealth@nt.gov.au

NT Specialist Outreach

Meet with a visiting medical service - NT.GOV.AU

Specialist Outreach NT manager

Phone: 08 8922 7752

Email: sont.dhf@nt.gov.au

Definitions

Term	Definition
ADWG	Australian drinking water guidelines
BLL	Blood lead level
CDC	Centre for Disease Control
EBLL	Elevated blood lead level
EDTA tube	
EHO	Environmental Health Officers
Elevated blood lead level	A blood level greater than 5 micrograms per decilitre (mcg/dL) (equivalent to greater than 0.24 micromoles per litre
FBC	
Guideline	Establishes the key principles and provisions that govern the decision –making process. Guidelines include advisory and explanatory statements offering detail,

Term	Definition
	context or recommendations for good practice and decision making which support policies and procedures. **In a clinical context these are usually mandatory. Any deviation from the guideline must be approved and documented.** (NT Health Policy Development Procedure)
LFT	
NHMRC	National Health and Medical Research Council
NTNDS	NT Notifiable Diseases System
Pica	The persistent eating of substances such as dirt or paint that have no nutritional value.
Policy suite	A collection of documents on a specific subject matter that is corporate or clinical in nature, in order of hierarchy as per the document pyramid in the Policy Governance Framework Model. A policy suite would usually consist of a parent policy and be supported by a procedure and/or guideline (NT Health Policy Development Procedure).
UEC	
VSA	Volatile substance abuse
WHS	Work Health and Safety
XRF	X-ray fluorescence

Appendices

Appendix A: Supplementary guidelines for management and referral of people with elevated blood lead levels due to aviation gas (Avgas) sniffing

In early 2017 it became apparent that an outbreak of Avgas sniffing had occurred in some communities in East Arnhem leading to elevated blood lead levels. Avgas sniffing may be more widespread. This supplementary document details the investigation and management of solvent abusers suspected of sniffing Avgas including referral procedures.

Testing of blood lead levels in the context of volatile substance use

Who to test:

Clinical presentation of lead toxicity is a difficult diagnosis and often elevated lead levels remain asymptomatic. So, in addition to testing of patients with suspected lead toxicity based on clinical presentation, please also consider lead testing in:

1. Communities where there is *definite* evidence of Avgas sniffing
    - Active recall for testing of all those known or suspected to be abusing Avgas

    AND

    - Opportunistic testing of any presentation of volatile substance abuse.
2. Communities where there is *the possibility* of Avgas sniffing (Avgas available with or without reports of theft)
    - Opportunistic lead testing of anyone with known or suspected volatile substance abuse

What to test for:

- standard workup of volatile substance misuse as per CARPA (8th ed. pp. 299-301) AND
- blood lead level
- full blood examination
- iron studies
- UEC
- LFT

How to test:

Two purple top EDTAs (one for FBC, one for lead, as they go to different laboratories) and **one yellow top** (iron, UEC and LFTs).

Management of elevated blood lead levels in the context of Avgas sniffing

If elevated blood lead levels results are found in the context of AVGAS sniffing, then an essential **first step is to make every effort to prevent any further solvent abuse.**

Based on the level:

5 - 9.9 mcg/dL

- clinical **assessment**
- **treat iron deficiency** if indicated
- **engage with family** for education with Social and Emotional Wellbeing, family or youth support workers or Volatile Substance Abuse team if available. *If the practitioner believes the person is at risk of severe harm they can refer to the VSA team under the volatile substance abuse prevention act (VSAPA) by filling out a* Request-for-assessment-under-the-VSA-prevention-act form
- a report to Territory Families is necessary if you become aware that a child is engaging in VSA and you do not believe that there is an adequate response already in place. Children who are engaged in VSA are likely to cause serious harm to themselves, and potentially to others. Contact the Child Protection Hotline on 1800 700 250 or complete the CARE Services online reporting form. Further detail can be found in the Professional Reporters Guide.
- **refer to paediatrician** if a child (<16 years) for outpatient visit (non-urgent)
- **recall** for repeat lead levels in 6 months.

10 – 19.9 mcg/dL

- as above
- refer to paediatrician if a child (<16 years) for outpatient visit at next paediatric visit to community and notify usual paediatrician (for child or region) via email
- recall for repeat lead levels in 3 months.

20 – 44.9 mcg/dL

- as above
- recall for repeat lead levels in 1 month
- notify on call paediatrician if a child (<16 years).

45 – 69.9 mcg/dL

- arrange admission to hospital for children, consult a physician for adults
- discussion with duty rmp regarding transfer (low acuity patient transfer preferred)
- notify admitting team for impending transfer.

≥ 70 mcg/dL or acutely unwell children or adults with symptoms of lead toxicity, with any blood lead level

- urgent admission to hospital
- liaise with duty rmp for urgent evacuation
- notify admitting team for impending transfer.

Case coordination

Elevated BLL information will automatically be sent from laboratories to the CDC. The regional CDC Unit can provide public health advice and/or instigate further investigation/interagency responses into cases of elevated BLLs due to Avgas sniffing.

Appendix B: 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

Source: National Health and Medical Research Council. 2015 *NHMRC Information Paper: Evidence on the Effects of Lead on Human Health*. Canberra: National Health and Medical Research Council; 2015

Appendix C: Environmental Health response

Environmental Health may be requested to complete an onsite investigation if the Lead Exposure Questionnaire points to a potential source or the source is considered unknown.

Prior to any field investigation a joint meeting between the treating Physician/Allied Health Services (Social workers, Aboriginal Health Practitioner, Health Promotion Officer), CDC and Environmental Health should be initiated. This meeting provides an opportunity to discuss the elevated BLL case(s) history, and the completed Lead Exposure Questionnaire. It also provides a forum to collectively discuss possible sources, including whether the exposure is likely behavioural or environmental.

Patterns of exposure are not well documented in the NT, however behavioural exposures appear to be more common. Investigations therefore should initially focus on the confirmation or discovery of a behaviour. Environmental exposures (air, water and soil), including those associated with housing infrastructure, are secondary. Incidents of environmental exposure appear to be mainly associated with commercial mining operations.

Common behaviour related exposures include the consumption of food containing lead gun shot, handling or making of lead sinkers, and handling of lead containing materials. If the source is unknown it's important to keep an open mind and consider all possible sources outlined in the 'Resources' section of this document.

The investigating Environmental Health Officer (EHO) may determine it necessary to obtain environmental samples if no behavioural exposures are confirmed and when:

- soil around the case(s) home or recreation areas contain soil fill
- water supplies are from high risk water sources such as rivers or other private supplies that are not regularly monitored
- the house was built pre 1978 (use of lead based paints have since been banned)
- the community concerned is located near an existing or legacy mine
- elevated BLL results are not isolated to one family or residential property.

Environmental Health Investigation Process

Planning investigation:

- meet with Health Service and regional CDC representative. Consider the Lead Exposure Questionnaire and background information regarding the case(s) home and workplace. Note that some cases might live part of their time in other communities
- build an onsite investigation team (health service, housing, relevant water authority)
- prepare all necessary equipment to take onsite including any sampling equipment.

(NT Health owned XRF Machine may be used to sample soil and paint for lead content; users must hold a valid radiation licence to use the XRF machine.)

Onsite investigation:

- make observations of the home and yard, playground, landfill/dump or any other areas case(s) with an elevated BLL may have frequented

- obtain any samples and photos, ensure permission is given by the relevant owner
- initiate discussions with relevant person's onsite by explaining the reason for your visit
- the completed Questionnaire can assist in the unpacking of a 'lead exposure story'. Not only will this assist in the identification and restriction of lead sources, but it also provides an opportunity to educate to the health effects of lead exposure, sources which cause an elevated BLL and how restriction will assist in reducing the BLL.

Reporting

Detail findings and recommendations into a report to be forwarded to the regional CDC Unit.

Assessment of Samples

Trace metals analysis (including Lead Pb) can be completed using NT-based laboratories. Samples in soil and water are compared in accordance with the below relevant standard. Confirmation of the standard used by the laboratory should be confirmed on assessment.

Soil

Schedule B1 of the National Environment Protection Measure (NEPM) provides Health Investigation Levels (HILs) for lead and other contaminants. HILs are scientifically based, generic assessment criteria designed to be used in the first stage (Tier 1 or 'screening') of an assessment of potential risks to human health from chronic exposure to contaminants. They are intentionally conservative and are based on a reasonable worst-case scenario for four generic land use settings:

- HIL A - residential with garden/accessible soil (home grown produce <10% fruit and vegetable intake, (no poultry), also includes children's day care centres, preschools and primary schools
- HIL B - residential with minimal opportunities for soil access includes dwellings with fully and permanently paved yard space such as high-rise buildings and flats
- HIL C - public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools and footpaths. It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate
- HIL D - commercial/industrial such as shops, offices, factories and industrial sites.

HILs establish the concentration of a contaminant above which further appropriate health investigation and evaluation will be required. Levels slightly in excess of the HILs do not imply unacceptability or that a significant health risk is likely to be present.

The HILs for lead are as follows:			
HIL A – 300mg/Kg	**HIL B - 1200mg/Kg**	**HIL C – 600mg/Kg**	**HIL D – 1500mg/Kg**

Water

Australian drinking water guidelines (ADWG) set the health limit for lead in drinking water at 10µg/L.

Bottles should be obtained from a testing laboratory and sampling conducted in accordance with their procedures.

Samples should be taken at water supply outlet (e.g. bore) and kitchen tap. If a rain water/holding tank is used consider taking samples from the tank.

More information

To access more information go to Elevated blood lead level page.

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National Safety and Quality Health Service standards

National Safety and Quality Health Service standards							
Clinical Governance	Partnering with Consumers	Preventing and Controlling Healthcare Associated Infection	Medication Safety	Comprehensive Care	Communicating for Safety	Blood Management	Recognising & Responding to Acute Deterioration
☒	☐	☐	☐	☐	☐	☐	☐