Managing Lead Contamination in Home Maintenance, Renovation and Demolition Practices. A Guide for Councils.

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NSW EPA
ENVIRONMENT PROTECTION AUTHORITY

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Introduction

Lead is a heavy metal that is toxic to the human body when breathed, eaten or absorbed. It is particularly harmful to young children. Scientific research has overwhelmingly concluded that exposure to even low levels of lead can result in serious and irreversible health and behavioural problems, especially in young children.

There are many ways in which people are exposed to lead. Our extensive use of leaded petrol and both current and historical lead-emitting industrial activities have contributed to widespread distribution of lead in the environment. Studies have shown that one of the primary sources of lead contamination is unsafe home renovations, mainly from lead paint, contaminated cavity dust and contaminated soil.

There are over a million homes in NSW that were built before 1970 and are potentially contaminated with lead paint, dust and soil. It is estimated from 1997 figures that around 21% of households undertake at least one type of home improvement or renovation activity each year (BIS Shrapnel 1998). Many of these renovations are undertaken by owner-builders or private households ('do-it-yourself', or DIY), and are therefore not subject to WorkCover NSW regulations covering contractors and tradespeople.

Therefore, lead hazard management in home renovations needs to be addressed by all levels of government, industry and the community.

This document is designed to help councils manage lead hazards in home renovation and demolition activities and minimise the risk of lead contamination to the environment and human health through appropriate 'management tools'. These tools include educational, regulatory and planning tools and are discussed in Section 1.

One option for councils is to adopt a development control plan (DCP). An example of a lead DCP is given in Appendix 1. This was developed in association with the Lead Reference Centre (LRC) and local and state government representatives.

A DCP can be included as part of a broad strategy to minimise lead risk in the community. Implementing a DCP as a management tool will result in some additional costs to the building industry. These costs include increased project management time, additional training, equipment and labour. However, there may be significant benefits for human health and the environment as a result of reduced exposure to lead sources, especially for pregnant women and children exposed to unsafe home renovations.

How to use this document

This document has three sections.

Section 1 provides a general overview of lead issues and a discussion of appropriate management tools.

Section 2 contains technical notes that provide supporting information for council staff to help them educate developers and others.

Appendix 1 contains an example of a DCP that councils can implement.

Councils determine the approval framework and processes for most types of development. State significant development needs to comply at a minimum with all requirements relating to local development. This document provides a framework to allow councils to consider various ways of reducing the community's exposure to lead and lead contamination. A council strategy may involve the submission of a lead management plan (LMP), as part of requirements in a DCP.

In the case of exempt development, this material provides technical notes for council staff and information about educational resources available for distribution to the public. In the case of private activities (repainting, home renovation etc), councils' planning powers are limited, but councils may find a community education program about lead hazards to be an effective tool in minimising health and environmental risks. As part of this strategy the community could be told how to raise concerns about unsafe house renovations.

Councils can make use of this document by:

- applying the principles of lead hazard management in this document to their own activities
- informing the community of the hazards of lead and ways to minimise risk by raising awareness of, and making available, educational material referred to in this document
- promoting appropriate lead management work practices to developers and renovators through effective education programs
- considering adopting a DCP as council policy and using it with development applications
- ensuring that parties involved in development (developers and accredited certifiers) are aware of their need to comply with the provisions of the DCP when one exists.

This document focuses on the management of lead contamination in home maintenance, renovation and demolition activities.

Section 1: Management of lead contamination

Sources of lead contamination

Unsafe home renovation is one of the most common causes of high lead levels and lead poisoning among children in NSW (EPA 1998). Lead can affect the health of all people, but foetuses, pregnant women, and children under the age of four are most at risk. Up to 1970, lead was the major ingredient in paint, used as a base, as a drying agent, as colouring and to protect steel and iron from rust. Preparation of old lead paint surfaces using power sanders and blow torches can create fine lead dust and fumes, which can extensively contaminate the home, furnishings and surrounding areas. Lead dust is dangerous when inhaled or ingested.

Exposure of babies and small children to even small doses of lead will cause their blood lead levels to exceed the recommended maximum of 10 μg/dL (micrograms per decilitre), set by the National Health and Medical Research Council (NHMRC) in June 1993. This maximum was reduced from the previous limit of 25 μg/dL set in 1985 (LRC 1997).

Ingestion of a piece of flaking lead paint the size of a 20 cent piece by a small child can be enough to exceed 10 μg/dL. Fine lead dust created by power sanding of lead-painted surfaces is particularly hazardous, as the particles are more readily absorbed into a child's bloodstream. Recent anecdotal evidence suggested that fine lead dust from renovation work caused a blood lead level of over 35 μg/dL.

Renovations can disturb lead-contaminated dust built up over many years in ceiling cavities, behind walls and between or under floorboards.

Primary sources of lead dust include:

- industrial pollution
- car exhaust (from leaded petrol)
- breakdown of old lead paint
- previous renovations in the home
- emissions from burning coal or lead-painted wood.

Health effects of lead

The two primary means of lead contamination in humans are through breathing in dust or fumes that contain lead or by swallowing food or water that contain lead. High lead levels can cause serious long-term health problems and harm almost every part of the body, especially the brain, kidneys and reproductive organs. Lead can damage the developing brain and nervous systems of unborn children much more easily than those of adults (Table 1).

Many children and adults with increased levels of lead in their bodies may show no symptoms, even though their health is being affected. When symptoms do become obvious they include lethargy, stomach pain or constipation, headaches and irritability. Children show these symptoms at lower levels of exposure than adults do.

When absorbed into the body, lead in blood has a half-life of around 28 to 35 days. Lead is readily absorbed and quickly distributed to the blood (1%), soft tissue (4%) and bones and teeth (95%). Lead stored in the body remains a source of internal exposure with a half-life of 20 to 30 years in bone, from where it can be mobilised back into the blood (LRC 1997).

Table 1. Key health impacts of lead

Children	Pregnant women	Adults
Impaired growth	Pre-term delivery, low birth weight and stillbirth more likely at higher levels of exposure	Joint and muscle pain
Reduced hearing		Loss of libido
Behavioural problems	Low levels of exposure can damage the foetus, as lead passes easily through the placenta	Infertility
Learning disabilities		Mood swings and aggressive behaviour
		High blood pressure

Lead poisoning of both children and adults due to very high exposure can cause memory loss, nerve problems such as paralysis, fits and in extreme cases death.

Environmental impacts of lead

Although lead occurs naturally in the environment, it plays no known beneficial role in biological processes (Gulson 1996). Lead is classified as a 'toxicant' that can affect a broad spectrum of species and remain in the environment for a long time. High levels of lead can cause death in many birds and mammals. They can also affect the population dynamics, dietary patterns, morbidity and sex distribution of animal species. Lead contamination also affects biological systems by affecting ecosystem productivity (inhibiting plant growth) and nutrient cycling (Gulson 1996). High levels of lead in soil are known to affect both soil organisms and plant productivity. Collective damage to these groups of organisms disrupts the cycling of nutrients through an ecosystem, often resulting in the displacement of lead-intolerant species with lead-tolerant species.

Soil and dust provide pathways for exposure of children to lead from renovations, petrol emissions and industrial sources. As a stable chemical element, lead deposited in soil or dust becomes a long-term source of exposure. Soil in the inner city and along major traffic routes can have lead concentrations well above recommended levels. The Inter-Departmental Lead Taskforce (EPA 1994) noted that the removal of lead-based paint from structures and the demolition of buildings containing lead products add to the lead loading of surrounding residential areas. The Taskforce recommended that control measures be developed and implemented to minimise this source of lead contamination.

Management approaches for lead hazard reduction

It is important that councils consider and, where appropriate, implement the management approaches outlined below. Three of these are outlined. They may be used specifically or integrated to form a multi-faceted approach.

Education tools

An education strategy is a non-regulatory option that can provide an effective and alternative means of reducing the risk to human health and the environment. It can be particularly useful where activities do not require planning approval or compliance. Councils may be able to

contribute to educating the general community on issues such as lead hazards and risks.

Education tools are an effective way to reach a broad audience, particularly for activities that do not require formal council approval (e.g. minor domestic internal alterations and renovation). In the achievement of a holistic lead management strategy across a community, non-regulatory activities need to be integrated so that they are consistent with the principles of any planning or regulatory approaches adopted.

There are many educational resources and fact sheets available for DIY and professional renovators. Councils can use these resources in a community or vocational education program. Councils might consider a series of community education seminars, trade nights, an information stall at a local shopping centre or community event, or attaching fact sheets to building applications. Refer to Technical Note 7 for a list of references and education resources.

Education may also be used to influence the practices of developers and workers in the building, construction and demolition industries. In developing an education strategy, councils will need to liaise with industry representatives to determine the most effective method of disseminating the key issues and messages. The EPA's website (www.epa.nsw.gov.au) contains material that can help councils to develop education programs. Similarly, a document called *What We Need Is...a Community Education Project* is available by calling the EPA's Pollution Line (131 555). This document details the following eight-step 'effective education planning' process:

Step 1 Analyse the issue or problem

Step 2 Identify stakeholders

Step 3 Know your target group

Step 4 Determine objectives and outcomes

Step 5 Design your methods

Step 6 Consider funding

Step 7 Make an action plan and implement it

Step 8 Monitor and evaluate.

This process is particularly relevant for councils wishing to address lead issues.

Regulatory tools

A council need not rely on planning or educational measures alone to manage lead hazards. The power to control pollution caused by lead hazards is given to councils under the *Protection of the Environment Operations Act 1997* (POEO, July 1999). Councils can use clean-up or prevention notices to control activities that do not require development consent but are causing lead hazards. Clean-up notices may direct an occupier of premises reasonably suspected of causing or having caused pollution to clean up as specified in the notice. Prevention notices can be issued if a council reasonably suspects that any activity has been or is being carried on in an environmentally unsatisfactory manner at any premises or by any person. Prevention notices require that action specified in the notice be taken.

Further information on issuing notices under the POEO Act is available from:

- the EPA website—www.epa.nsw.gov.au
- the *Environment Protection Manual for Authorised Officers—Guide to Notices* (1999) (available from the EPA Pollution Line on 131 555 or from the EPA website)
- *New Environment Protection Legislation*, Macquarie Research Limited 1998 (short-

course training material available on the EPA website).

In certain circumstances councils can consider implementing section 124 of the *Local Government Act* to serve orders on an owner or occupier of premises to 'ensure that their land or premises are placed or kept in a safe and healthy condition'. For example, an order could be served on occupiers to stop unrestricted abrasive blasting next to a childcare centre.

Planning tools

Activities that are part of a local or integrated development require council approval (e.g. refurbishment of commercial property, second-storey addition) and could be subject to the conditions of a lead DCP.

The model lead DCP in Appendix 1 was developed by the LRC and local government. Councils should consider it as a management option and customise it as required. It provides guidance on placing appropriate conditions on development consents where there is potential for lead contamination in renovation, demolition and landscaping activities in the domestic sector. Councils implementing a DCP would be able to require developers and renovators to identify lead risks **before** undertaking an activity, such as by filling out a lead risk checklist. There is a sample lead risk checklist in the model DCP in Appendix 1.

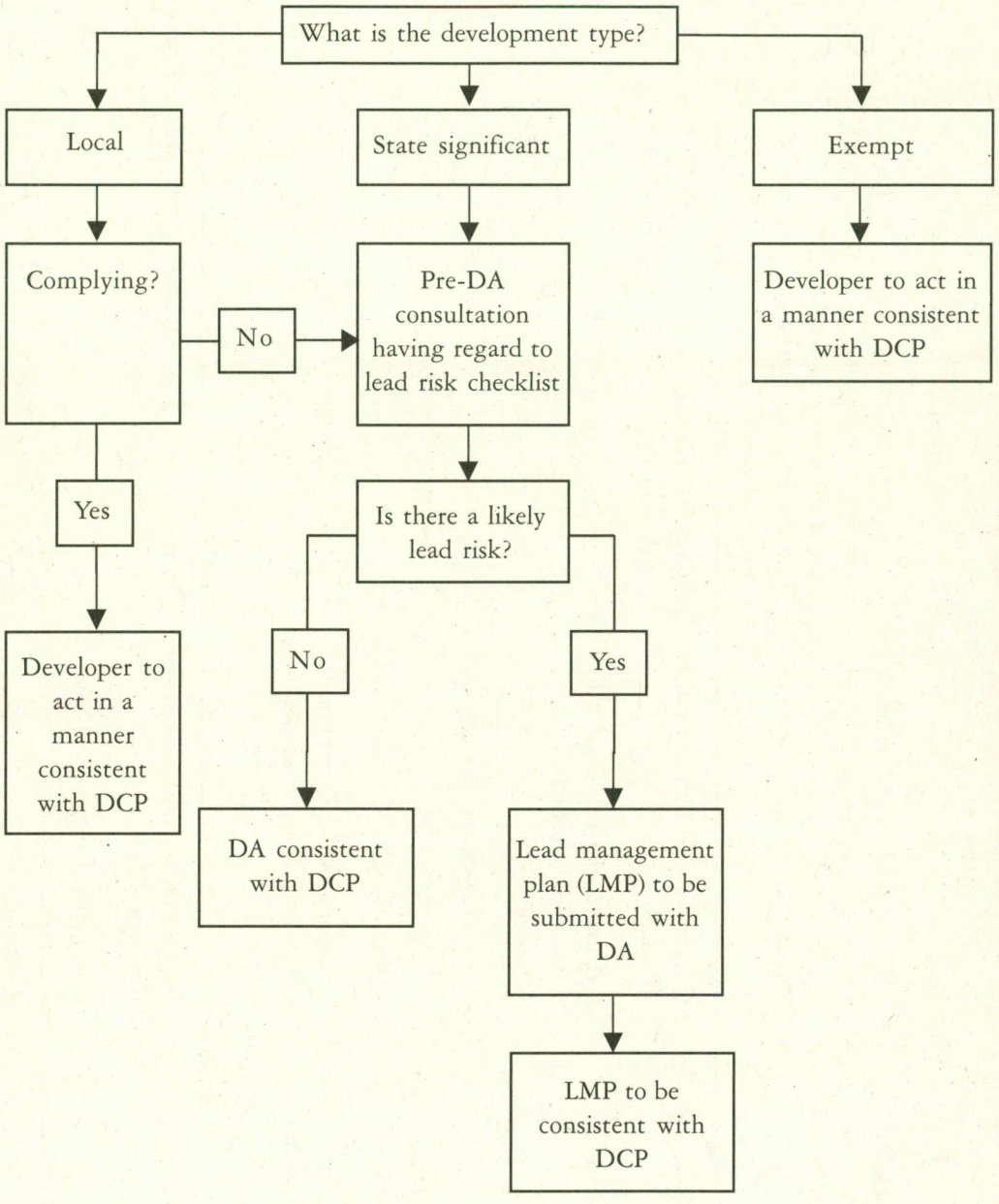
The checklist may need to be developed further to accommodate local issues and demographics. The example provided simply prompts a 'yes' or 'no' response from the proponent, but a format that both identifies the potential risk and scales it as 'high', 'medium' or 'low' may be preferred. If an activity is identified as involving a high lead risk (e.g. a pre-1970 house located within 50 metres of a school is being partly demolished and then renovated with a roof loft addition), a council could require an LMP to accompany the development application. An LMP provides an opportunity to outline the strategies to be employed by the proponent to minimise the risk of lead contamination during the work. Similarly, a returned checklist identifying a proposal to demolish an unpainted, single-brick external laundry with only the door, window frames and minor decorative fixtures being painted may be deemed a 'low risk' not requiring an LMP. The asssessment process is shown in Figure 1.

A cost-benefit analysis of implementing a DCP found that implementing a DCP would create additional labour, goods and service costs (e.g. requiring vacuuming of ceiling cavities). The extent of these cost increases would depend on the scale of the development activity and its associated lead risk. However, there would be substantial benefits for the health of children, the general public and industry workers from lead safe practices.

The model DCP identifies other regulatory controls that cover lead management. These include the POEO Act 1997, *Contaminated Land Management Act 1997* and *Occupational Health and Safety Act 1983* and associated regulations. It also complements Australian Standards on lead hazard management (AS 4361.1—Industrial and AS 4361.2—Residential). Australian Standards for lead management are designed as 'best practice standards' and have no legal standing on their own unless incorporated into state regulations.

The DCP does not duplicate state regulations; rather, it provides a context for their implementation in development consents (Table 2).

Figure 1. Assessing the risk of lead contamination



Councils that administer areas with a significant proportion of older housing (pre-1970) should consider the additional benefits of adopting a DCP, as the lead risk may be higher. Although adoption of the DCP is voluntary, councils with lead concerns may need to amend the model DCP to meet local conditions and complement existing policies. Inner city councils such as Leichhardt have already adopted the key provisions of the model DCP into their planning instruments.

While a DCP can cover a wide range of development activities, the focus of the activities covered under this model DCP is primarily residential. However, for major industrial and other developments which may pose lead risks, the information in the model DCP may not be adequate. Applicants for these developments are responsible for sourcing information according to the characteristics of the development and the level of lead risk posed to public health and the environment.

Table 2. DCP requirements and existing regulations relevant to the DCP process

Activity	Requirements of lead DCP	Possible requirements of other regulations	New requirement	Enforcement authority
Planning a development	Council to nominate if LMP required. Management plan dependent on level of lead risk.	LMP similar to work method statement required of contractors and individuals by WorkCover NSW.	Yes—both contractors and individuals. But not required in all situations. Standardised management plans may suffice.	Council, WorkCover NSW
Renovation, refurbishment or demolition	Work area prepared to contain lead dust. Approved equipment and practices must be used. Clean up with HEPA vacuum or wet wipes. Waste disposal classified and waste suitably handled and disposed of. No demolition in high winds. Mist sprays to suppress dust.	Occupational Health and Safety Regulation 2000.* Occupational Health and Safety (Hazardous Substances) Regulation 1996. *Factories, Shops and Industries Act 1962*. POEO Act 1997. Protection of the Environment Operations (Waste) Regulation 1996.	Only to individuals (DIYs) if development consent required.	WorkCover NSW, Council
Landscaping	Adopt strategies to prevent or reduce lead hazards in the environment. Work practices to reduce hazards to workers.	Occupational Health and Safety Regulation 2000.* Occupational Health and Safety (Hazardous Substances) Regulation 1996.	Only to individuals (DIYs) if development consent required.	WorkCover NSW

* The Occupational Health and Safety Regulation 2000 took effect on 1 July 2001, replacing 36 regulations made under various Acts relating to construction and building.

Renovation activities

The following information will help councils deal with the most significant local sources of lead contamination from home renovation and demolition activities.

A significant variety and number of home renovations are undertaken in NSW each year. Renovation work can pose a risk to human health through disturbing lead paint. If lead paint is present, any preparation and repainting poses a lead hazard. Demolition and landscaping can also pose a risk through disturbing old lead dust contained in ceiling cavities and walls or in the soil.

Table 3 outlines projects that may involve some risk of lead exposure. In council areas where development consent for an activity is required and a lead DCP is applied, the risk to the environment, workers, children and their families may be reduced. Where home renovations and landscaping work are undertaken by private individuals (DIY) and are exempt from development consent, a DCP will have little impact. However, councils can use the information in the model DCP (Appendix 1) as the basis for developing and promoting an education strategy to warn renovators of the potential lead risks involved in some activities.

The DCP example sets out a range of best practice measures to be followed for renovation, demolition and landscaping. In many instances, the measures outlined in the DCP are already requirements for contractors and tradespeople, who are obliged to comply with WorkCover NSW regulations regarding safe work practices. However, a report by BIS Shrapnel (1998) into the home improvement market indicates that householders undertake a significant proportion

Table 3. Number and cost of renovation projects in NSW in 1997

Project	Usually requires development consent	No. of jobs in NSW	Average cost (1997)
Ground floor additions	4	45 600	$25 614
Upper floor additions	4	19 800	$39 768
Garages	4	39 500	$6 441
Kitchen additions/extensions	4	147 700	$5 742
Bathroom and laundry additions/extensions	4	153 500	$4 141
Cosmetic renovations	6	57 200	$1 836
Window replacement	6	94 800	$1 965
Relining internal walls and ceilings	6	110 800	$892
Ceiling insulation (retrofit)	6	43 000	$1 595
Recladding of eaves and gable ends	6	24 00	$879
Total		736 000	–

Source: BIS Shrapnel 1998, *Home Improvement Market in Australia*

of renovation work (Table 4). WorkCover NSW regulations have no control over these activities, and consequently many home renovations may be undertaken unsafely.

Painting on its own does not require council approval; therefore, the impact of a DCP in controlling this type of lead risk is limited to where painting is part of broader renovation works (such as a new kitchen or extension). However, where it is found that individuals or contractors are performing unsafe renovation works, councils may issue a clean-up notice or prevention notice under the POEO Act or issue an order under section 124 of the *Local Government Act 1993* relating to a health hazard.

The management of waste generated on-site is an important environmental and health aspect of renovation activities. Without careful management and containment of lead-contaminated waste, exposure to toxic substances may result. Waste contaminated with lead (including dust and paint scrapings or flakes) from residential premises, educational institutions or child-care centres is already classified as solid waste in Schedule 1, Part 3, of the POEO Act 1997. This waste can be disposed of to a Solid Waste Class 1 or Class 2 landfill. Waste contaminated with lead from other sources (such as retail or industrial premises) would need to be classified in accordance with the EPA's 1999 *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes*. Once waste is classified, the appropriate transport and disposal requirements are identified. The model lead DCP does not impose new or additional conditions in regard to waste disposal, but refers to the existing provisions of the POEO Act encouraging local authorities to apply a consistent regulatory approach to all scales of building, renovation and maintenance.

Table 4. Who undertakes home improvement work?

Project	Householder or DIY activity (%)	Contractor or trades-person (%)	Combination: DIY/trades-person (%)	Total (%)
Ground and upper floor additions	23	54	23	100
Garages	45	43	12	100
Kitchen renovations	28	56	16	100
Bathroom renovations	35	48	17	100
Laundry renovations	40	43	17	100
Window replacement	33	63	4	100
Relining internal walls and ceilings	49	43	8	100
Ceiling insulation (retrofit)	56	43	1	100
Recladding of eaves and gable ends	30	66	4	100

Source: BIS Shrapnel (1998), *Home Improvement Market in Australia*.

Section 2: Technical notes to help in management of lead contamination

Technical note 1: Lead information

Broad sources of lead

Lead paint and lead-contaminated dust are the major sources of health risks to people in most domestic and occupational environments. This document focuses on managing lead in home renovation and demolition activities.

- Most paint made before 1970 contained significant quantities of lead. The carrying out of renovations, building, maintenance and demolition activities in pre-1970 buildings can often result in contamination, and expose renovators, occupants and neighbours to significant health hazards.
- Buildings have used and may continue to use lead products, such as lead flashing on roofs and lead solder in water pipes.
- Certain industrial activities, both historical and current, can contaminate industrial premises and neighbouring areas.
- Businesses and householders may release lead into the environment by disposing of lead waste or products improperly, carrying out renovations, doing boat or car repairs, or engaging in hobbies such as leadlighting.
- Public and commercial buildings and structures built and painted before 1970 may contain paints containing much more than 1% lead. These may include childcare centres, community or early childhood centres, schools, hospitals and heritage properties. Nearby yards, parks and vacant land may also have been contaminated by lead paint removed by abrasive blasting or demolition of lead-painted structures.
- Land may be affected by lead from the placement of fill containing waste or slag or from previous buildings on or industrial usage of the site.
- Bridges, wharves, towers and water tanks may be coated with paints containing lead, which have been and may still be used to reduce corrosion, increase longevity and reduce maintenance and replacement costs.
- Land near heavily trafficked roads, petrol depots or processing industries may be contaminated by former petrol emissions. The widespread historic use of leaded petrol, paint and other products and industrial activities using lead have made it difficult or impossible to identify individual lead sources without specialised analytical testing. In Australia, research on lead in soils has focused on lead deposition from petrol exhaust near roads and from point sources. American research has found elevated lead levels within a metre of home foundations when soil has not been disturbed and near downpipes. New Zealand research found soil lead levels of 16–28 ppm in homes built less than 10 years ago but 455–16 858 ppm in homes built over 90 years ago.

Regardless of how lead is released into the environment, it does not break down. Unsafe practices such as abrasive blasting or demolition and industrial activity can create localised lead hotspots that may pose hazards to children and pets long after work ends.

Emissions from leaded petrol increase levels of lead in blood across the population, especially in people who live near main roads. Reduction in the use of leaded petrol since 1986 and reduced amounts of lead in petrol have reduced the risk from this source of exposure. However, the historic accumulation of lead in soil and contaminated dust in ceilings and walls remains a hazard.

Food made and bought in Australia tends to have low lead levels. A risk of lead contamination may occur when root vegetables are grown in contaminated soil or leafy vegetables gather lead dust. Of greater concern is accidental contamination of food and drinks stored, cooked, reheated or served in imported, crafted or antique lead-glazed ceramics, leaded crystal, pewter or glass.

Lead may enter the household water supply from leaded plumbing materials and household plumbing fixtures. Water from lead-soldered tanks or runoff from roofing coated with lead paint can pose a risk, especially in areas near mines and smelters where dust and emissions could add to the problem, but no data is available on tank water quality.

Health effects of lead exposure

Over the last two decades, there has been a significant increase worldwide in the awareness of and concerns about the effects of lead on human health and the environment. In June 1993, the NHMRC revised its guidelines for lead in Australia. It set a specific goal 'to achieve for all Australians a blood lead level of below ten micrograms per decilitre (0.48 micromoles per litre)'.

The adverse effect of cumulative exposure from all lead sources and exposure pathways on human health is now well recognised. International consensus has also been reached that residual environmental lead contamination occurs worldwide, owing to industrial activities and the widespread use of lead in paint and petrol. Lead poisoning has been considered the top environmental health hazard for children under six years of age in the USA since 1991.

Lead can affect anybody, but children under the age of four and pregnant women are most at risk. The poisonous effects of lead can damage the developing brain and nervous system of unborn and young children much more easily than those of adults. The path by which the lead enters the body—via inhalation, ingestion, absorption through the skin or *in utero* exposure—influences the amount of lead absorbed. If absorbed it can harm virtually every system in the human body.

Inhalation is the main form of exposure in the workplace. Inhaled lead fumes and fine lead particles are deposited in the lungs. A high percentage can be transferred directly to the blood stream through the lung walls. Consequently, exposure to lead fumes poses a serious hazard to workers, and precautions are necessary.

During the renovation of a home that was painted with old lead paint, adults, children and pets can easily breathe in lead dust and particles if proper precautions are not taken.

Ingestion (eating and swallowing) is the most common route of exposure for children, and for adults who do not work with lead. Anyone can ingest lead through eating, smoking or nail-biting with lead-contaminated hands or in lead-contaminated work environments. Children under the age of four absorb a much higher proportion of lead than adults, and normal behaviour such as crawling, chewing objects and putting hands in the mouth makes them more likely to find and swallow lead if their environment is contaminated.

Absorption of certain forms of lead, such as the lead additives used in petrol, lead acetate and other lead compounds used in chemicals and manufacturing can occur through the skin.

Much less commonly, lead entering the body of women who are pregnant can be transferred to the foetus (***in utero* absorption**). As women's bodies change during pregnancy, previously stored lead can be released from the bones and affect the health of the developing foetus. This can be serious if the woman has high lead levels and is not eating enough calcium, iron or zinc.

Symptoms of lead exposure

At low levels most children and adults show no immediate symptoms. At higher levels, early symptoms include a fall off in physical fitness, fatigue, sleep disturbances, headache, aching bones and muscles, and digestive symptoms such as stomach pains and decreased appetite. Intense stomach cramps and pains, often associated with chronic constipation, sickness and vomiting, and colic have long been identified with serious lead exposure and lead poisoning.

The role of NSW Government sectors in managing lead hazards

NSW Health

NSW Health manages the notification system for lead poisoning in adults and children, and monitors the prevalence of lead poisoning in NSW. At an operational level the 16 public health units play an important role in supporting private health care providers in identifying and managing children with elevated lead levels. They collect notification data and are available to give technical support to local government and the public generally. Public health units will intervene in cases of childhood lead poisoning.

WorkCover NSW

WorkCover NSW is concerned with injury prevention and management in the workplace and works with industry to help achieve safe and healthy workplaces. Under the *Occupational Health and Safety Act 1983*, employers must ensure the health, safety and welfare at work of all their employees. WorkCover NSW can assist with information about:

- regulations and requirements on lead at work sites
- sources and health effects of lead in the workplace
- lead hazard management practices and standards
- protective equipment
- medical practitioners authorised by WorkCover NSW
- HEPA vacuum cleaners recommended for removal and collection of lead dust.

WorkCover NSW inspectors enforce lead management practices and occupational health and safety requirements in the workplace and regulate demolition contractors. They can be called to a workplace where work involving lead is being carried out unsafely and stop work until the work practices meet requirements.

NSW EPA

EPA officers have a number of roles and responsibilities in protecting the environment from lead contamination:

- responding to and referring public inquiries and complaints received through Pollution Line
- regulating industry and activities as scheduled under the POEO Act

- regulating contaminated land that poses significant risk of harm to human health or the environment under the *Contaminated Land Management Act 1997*
- helping and cooperating with other agencies, especially local government
- monitoring and reporting on scheduled premises, Sydney Harbour waterways, pollution from lead industries and point sources, and metropolitan air quality
- advising on methods for reusing, recycling, transporting and disposing of lead-contaminated waste
- providing technical advice and assistance on NSW environmental legislation and guidelines via Pollution Line, the EPA website and community education and information programs.

PlanningNSW

As part of its role in regulating the development control and planning approval process, PlanningNSW is responsible for ensuring that the environment is not exposed to risks as a result of decision making during the planning process. *Managing Land Contamination* planning guidelines, published jointly by the then Department of Urban Affairs and Planning (DUAP) and the EPA in 1998, is part of a package of reforms introduced in 1998 to provide a comprehensive, consistent, whole-of-government approach to contamination and remediation. Although the guidelines apply specifically to land contamination, the broad principles are applicable to other forms of contamination, which need to be considered as part of the planning and development control process.

Technical note 2: Risk factors and testing

If you assume that paint applied before 1970 contains lead, you may not need to test. But testing before renovations, maintenance, demolition and landscaping can clarify the risk. Alternatively, samples can be collected and stored for future testing should a dispute arise.

Take the precautions outlined in this plan and other documents listed in the References. Australian Standard AS 4361.2, 1998, describes the strengths and weaknesses of three methods of detecting lead in residential and commercial buildings—chemical field test reagents, portable X-ray fluorescence analysers and laboratory analysis.

If you wish to test, you can collect samples by using the following methods. However, these are very different from the sampling required to characterise a contaminated site or to support environmental assessments. You can obtain guidelines for sampling and testing for those purposes from the EPA, local authorities, environmental consultants, or consultants offering lead assessment services.

Where to test for lead

Ideally, it is important to sample where you are most likely to find contamination without the need to conduct hundreds of tests.

Lead paint in buildings built before 1970 is most likely to be present on timber trim such as windows, doors and skirting boards. Testing should focus on those areas at a minimum.

Dust testing may be appropriate for ceiling dust or wall voids when extensive roof or ceiling work or home renovations or demolitions are being undertaken or for clearance testing to allow buildings to be reoccupied where children may be at risk. Clearance testing for reoccupancy should be performed by experienced lead assessors.

Soil testing should focus on areas close to the foundations and exterior painted surfaces such as windows; and on bare soil where children play, gardens are planted or pets rest.

Sample also where visual assessment suggests sampling may be appropriate (e.g. visible paint chips in soil near a sandbox), near downpipes, or in areas where other lead-related activities may have occurred, such as boat or radiator repairing, fruit tree spraying or shooting.

Analytical testing for the presence of lead generally provides a total lead concentration in the paint, soil or dust. Where careful sample measurements are made in a measured area, a 'lead loading' or unit concentration per area may be calculated, but that is only appropriate when assessing the likely lead exposure and hazard posed to young children. Generally, the precautions required to manage lead hazards will not vary with lead loading.

How to collect samples for lead testing

As different laboratories may have different testing procedures, contact the lab to ensure that you follow its procedures. Label, date and place samples in a film canister, in specimen bottles or according to laboratory requirements.

For laboratory analysis:

1. Collect paint samples as an even square of $> 1\ cm^2$, cleanly removed with a razor blade.
2. Collect dust samples from hard surfaces such as floors and windows by using a wet wipe (not alcohol-based!), wiping it over an area of $> 10\ cm^2$ in an 'S' shape twice at right angles over the entire area.

3. Take soil samples of approximately 250 g (after removing rocks) with a clean spoon or trowel and place them in a specimen jar labelled with the sample location.
4. Collect dust samples from ceilings or where dust has accumulated as for soil.

Standards for lead concentrations

Lead in dust is an important source of exposure for young children because of their frequent hand-to-mouth activity and closer contact with dust and soil through crawling and play. The following dust standards are used as guidance in the USA and New Zealand for environmental investigations of lead poisoning:

- bare and carpeted floors—1000 $\mu g/m^2$
- interior window sills and ledges—5400 $\mu g/m^2$
- window troughs and exterior surfaces (verandahs, paths etc)—8600 $\mu g/m^2$.

In premises occupied by preschool children, these standards can be used to determine the safety of the premises for reoccupancy after renovation and clean-up are completed.

National councils have recommended the following investigation thresholds for lead in soil:

- 300 mg/kg in residential yards
- 600 mg/kg in recreational open space, playgrounds, parks and secondary schools
- 1200 mg/kg in multi-unit buildings where residents have limited access to soil
- 1500 mg/kg in commercial and industrial areas.

Technical note 3: The use of lead in paint, building products and industry

Paint

Many lead compounds have been used in primers, paints, enamels, inks, oils, resins and other surface coatings because of their unique physical properties. Surface coatings that contain lead are durable, UV-resistant and anti-corrosive. Lead paints produce strong, long-lasting colours and are capable of catalysing the drying of other oil paint components.

Table 5, although not an authoritative list, reflects information currently available on the past use of lead in components of houses, public and commercial buildings that are likely to be covered with lead primer, lead paint and other lead-containing surface coatings.

Paints containing around 50% lead before 1950 were replaced with paints containing less than 1% (10 000 mg/kg or ppm) by the early 1970s. But soil contaminated by paint containing 1% lead can still exceed the ANZECC limits for further investigation and clean-up—see the lead levels listed in Technical Note 2.

The lead content of domestic paint is now regulated under Appendix P of the Standard for the Uniform Scheduling of Drugs and Poisons. This allows no more than 0.1%. Lead paint, as defined by the Australian Standard, contains > 1% lead.

On many structures, particularly in far western NSW and in mining or industrial areas, industrial lead primers and paints containing higher lead levels than domestic paints may have been provided by industry to employees or were widely available locally. As a result, industrial paints may have been widely used on non-industrial structures. Similarly, the LRC received reports that in many coastal areas, marine paints containing higher lead levels than normal domestic paints have been used in residential housing and outbuildings.

Table 5. Where lead paint was used

Era	Interiors	Exteriors
Pre-1920	Most paint was lead-based. Individual painters mixed their own. It was used on trowel and lathe surfaces, on ceilings, as a primer and as a topcoat. Primary white pigment (lead carbonate) was mixed at levels of about 50% lead.	Most paint was lead-based. Individual painters mixed their own. It was used widely as a primer, surface coat and topcoat on exterior walls, window frames, doors, and verandah ceilings, railings and floors. Primary white pigment (lead carbonate) was mixed at levels of about 50% lead.
Pre-1950	Most interior surfaces were painted with lead paint. Primary white pigment (lead carbonate) was mixed at levels of up to 50% lead. Lead paint was used on the walls of wet rooms, particularly bathrooms, kitchens and laundries.	Nearly all exteriors were covered with lead paint. After the 1920s, lead carbonate was mixed with lead pigments—generally green, yellow, orange and red. Primer (lead monoxide & tetroxide) containing up to 60% lead was used on timber butt ends and exposed roofing surfaces.

Many structures are coated with lead or lead compounds:

- wooden and metal road and rail bridges
- railway stations and rolling stock
- power plant utilities and electricity pylons towers
- water and TV towers
- buses and ferries
- patrol and military vessels (coast guard, naval ships and submarines)
- military and defence structures
- ornamental iron and steel fencing and railings
- marinas
- boats and ships
- lighthouses and buoys
- wharves, weirs and stormwater infrastructure
- airport infrastructure, aeroplanes and jets
- cars, trucks and tractors
- road markings and signage
- roofing on industrial and residential premises.

The government required the use of lead primer and paint in housing and public buildings until the early 1970s. Until 1972, paint specifications issued by the Government Painting Committee for public housing, schools and hospitals required the use of lead primer, lead paint or both.

The government also required the use of lead primers and paints on iron and steel structures until the 1980s. Sydney Harbour Bridge staff report mixing 'red lead' primer for the NSW State Government until 1986. Red lead primer formulations mixed by bridge staff contained between 60% and 80% lead tetroxide. In 1989, all government paint specifications were revised, and specific requirements for the use of lead in paint for buildings or industrial infrastructure were removed. Protective coatings containing high levels, particularly hazard yellows and oranges, continue to be used today for industrial purposes. According to national requirements, such coatings require labelling with the specific percentage of lead used in the product.

Building products

Many building products containing lead have been, and still are, used in the building and construction sector.

- **Sheet lead** was used in damp-proof courses, waterproof linings, box and tapered gutters, cladding and facias and as protection against radiation, weathering and termites. It can be hazardous when handled, cut or burnt, or oxidised to a fine dust.
- **Lead flashing** was used to weatherproof gaps around windows, doors and chimneys, or between two roofs or a roof and a wall. Fumes created when soldering lead flashing are very dangerous. There is also potential for lead flashings in roof structures to contaminate rainwater collected in rainwater tanks.
- **Lead solders** or tin–lead solders are among the most common types of solder on the market. Solder can be used on copper pipes, electrical cables and fittings, rainwater tanks, flashing and electronics. Fumes created during soldering are extremely hazardous.
- **Lead water pipes and plumbing fittings** are used in very old houses and, if still in use, may contaminate the water they carry.

Antique brass or bronze plumbing fittings can contain high levels of lead. Modern fittings can still contain up to 4% lead.

- **PVC products** contain lead as a pigment and heat stabiliser. PVC breaks down if exposed to UV light for a long time and the lead can be released into the environment. Heating or burning PVC to bend or shape it can be hazardous.
- **Leadlight windows and glass** are a common decorative feature on older houses. Fumes produced by soldering, handling of lead 'cames' (strips of lead that hold the glass in place) and exposure to lead-based glass paints can be dangerous. The cames can also oxidise, forming a fine dust, which can be hazardous.

Industries using lead in processing

Table 6 has been adapted from *Managing Contaminated Land: Planning Guidelines* (1998 DUAP/EPA) and Australian Standard AS 4482.1, 1997—Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds.

Table 6. Where lead may be used in industry

Industry	Use
Agriculture and horticulture	Fertilisers and pesticides
Airports	Petrol and paint for propeller planes
Battery manufacture and recycling	Lead plate and lead oxides
Chemicals manufacture and use	Paints, pesticides and plastics
Defence works	Paint and components on buildings and infrastructure; explosives and ammunition in firing ranges
Electrical	Solder, lining in trunk cabling, and in cable coatings
Engine works	In petrol and in paint on metal machinery
Foundries	Paint on metal and lead in alloys
Gas works	In petrol and in paint on metal machinery
Marinas	Marine paints, ship keels, ballast and components
Metal treatments	Paint and galvanising on metal structures
Mining and extractive industries	Extracted from lead, zinc, silver and copper ores; used in petrol and in paint on metal machinery
Scrap yards	Paint on metal structures; scrap and alloys
Service stations and fuel storage facilities	Petrol
Smelting and refining	Extracted from ore concentrates, batteries and other recycled products
Wood preservation	Paint removed from timber

Technical note 4: Abrasive blasting and paint removal

Control of dust and environmental contamination during abrasive blasting can be difficult. Environmental requirements have therefore generally focused on measures to contain and control emissions, surface water runoff and noise where blasting occurs. Research by the US National Institute for Occupational Safety and Health, summarised in Table 7, demonstrates that abrasive blasting of lead-painted surfaces presents serious health and safety concerns for workers in both contained and open work areas. It may also present hazards to those nearby and to the local environment.

Table 7. Potential exposure to lead during abrasive blasting activities.

Levels exceeding the WorkCover NSW limit of 150 $\mu g/m^3$ are in bold

Activity to be undertaken	Lead exposure during task, $\mu g/m^3$ (range)
Chemical removal with caustic paste:	
• chemical removal	10 (1–40)
• water rinsing	18
• blasting after rinsing	3100 (2000–4700)
• blasting without rinsing.	5100 (5000–5300)
Wet abrasive blasting with water or abrasive slurry:	
• wet blasting	1600
• blast area.	2000 (1500–2900)
Power tool cleaning without local exhaust.	1000 (87–5000)
Isolation of workers by automated blasting equipment.	4 (2–5)
Vacuum blasting with local exhaust ventilation at the blast surface.	60 (30–80)
Abrasive blasting within enclosures:	
• large enclosure	6200 (2700–24000)
• small enclosure.	5600 (620–58000)
Abrasive blasting inside a loose-screen tarpaulin with natural ventilation:	5600 (340–29000)
• blasting	46 (6–190)
• in blast respirator.	60 (5–9100)

Taken from *Protecting Workers Exposed to Lead-Based Paint: A Report to Congress*, US NIOSH, January 1997

A draft code of practice for the abrasive blasting industry was developed in August 1997 by members of the Blast Cleaning and Coating Association of NSW in conjunction with Wollongong Council, the EPA and WorkCover NSW. This draft outlines the need to control environmental emissions and noise and to comply with Australian Standards, such as AS 4361.1, 1995.

Alternatives to traditional dry abrasive blasting of buildings and larger structures include overcoating, chemical stripping, wet blasting, using power tools with and without exhaust ventilation, and using blast and isolation chambers. These alternatives can reduce hazards to blast workers and other workers near the work area. With the exception of chemical strippers, these methods may also reduce environmental impacts, but further research is warranted.

Overcoating is the application of a new coating on top of existing coatings. It has been made possible by the design of specific overcoating products, but it is not appropriate in all situations. Because much less of the existing lead paint is removed or disturbed during overcoating, it reduces the potential risk to workers' health and the environment. In most cases, areas with corrosion or deteriorated paint are repaired before the whole structure is overcoated. The disadvantages are that the longevity of the overcoating depends on the quality of the old coatings, and the lead paint may need to be removed at some later date.

Chemical stripping involves spraying an alkaline chemical on the painted surface, allowing it to react, and then scraping the decomposed paint and excess caustic from the surface. If the surface requires subsequent rinsing, the water must be contained. Usually this process is followed by abrasive blasting to remove traces of remaining paint and to establish a suitable surface for repainting.

Wet blasting methods reduce dustiness associated with the removal of lead based paint. Both high-pressure water alone and water mixed with abrasive produce substantially lower dust emissions. Retrofit devices to fit over the end of conventional abrasive blast nozzles are available, and improve the rate of surface cleaning in wet blasting. All runoff water from wet blasting must be properly contained, collected and disposed of. Contaminated runoff containing lead would be classified as Group A waste as outlined in the EPA's environmental guidelines, *Assessment, Classification and Management of Liquid and Non-Liquid Wastes*. Group A waste requires treatment at a licensed liquid waste treatment facility. A trade waste agreement must be obtained from the appropriate water authority (Sydney Water, Hunter Water Corporation or local authority) before any liquid waste is disposed of to the sewer. The management issues of containment, collection and disposal of contaminated water need thorough consideration and should be identified in a work plan for paint removal projects.

Power tools can be used to sand, scrape or chip coatings from steel structures, allowing the removal of deteriorated paint while leaving paint in nearby areas intact. Power tools equipped with HEPA-filtered local exhaust ventilators, also known as vacuum tools, are used to reduce workers' exposure during lead paint removal. Vacuum tools can also reduce airborne lead emissions and can control and collect the waste better. Power tools are effective in controlling lead exposure when they are used properly.

Vacuum blasters are specialised abrasive blasting tools equipped with local exhaust ventilators. The exhaust system contains and collects dust, reduces airborne emissions, and controls and collects the waste better. Recycling of abrasive materials is also feasible, thus reducing material and disposal costs. Smaller vacuum blasters can be heavy and awkward to use, and tend to be more costly in terms of production rates than larger units.

Isolation and automation is a very promising method that removes the worker from the blast process.

General dilution ventilation uses negative air pressure to reduce dust emissions.

More dust control techniques are available than those listed above, and include blast enclosures, drapes and water curtains. It is important to select a technique that is most appropriate for the intended abrasive blasting application.

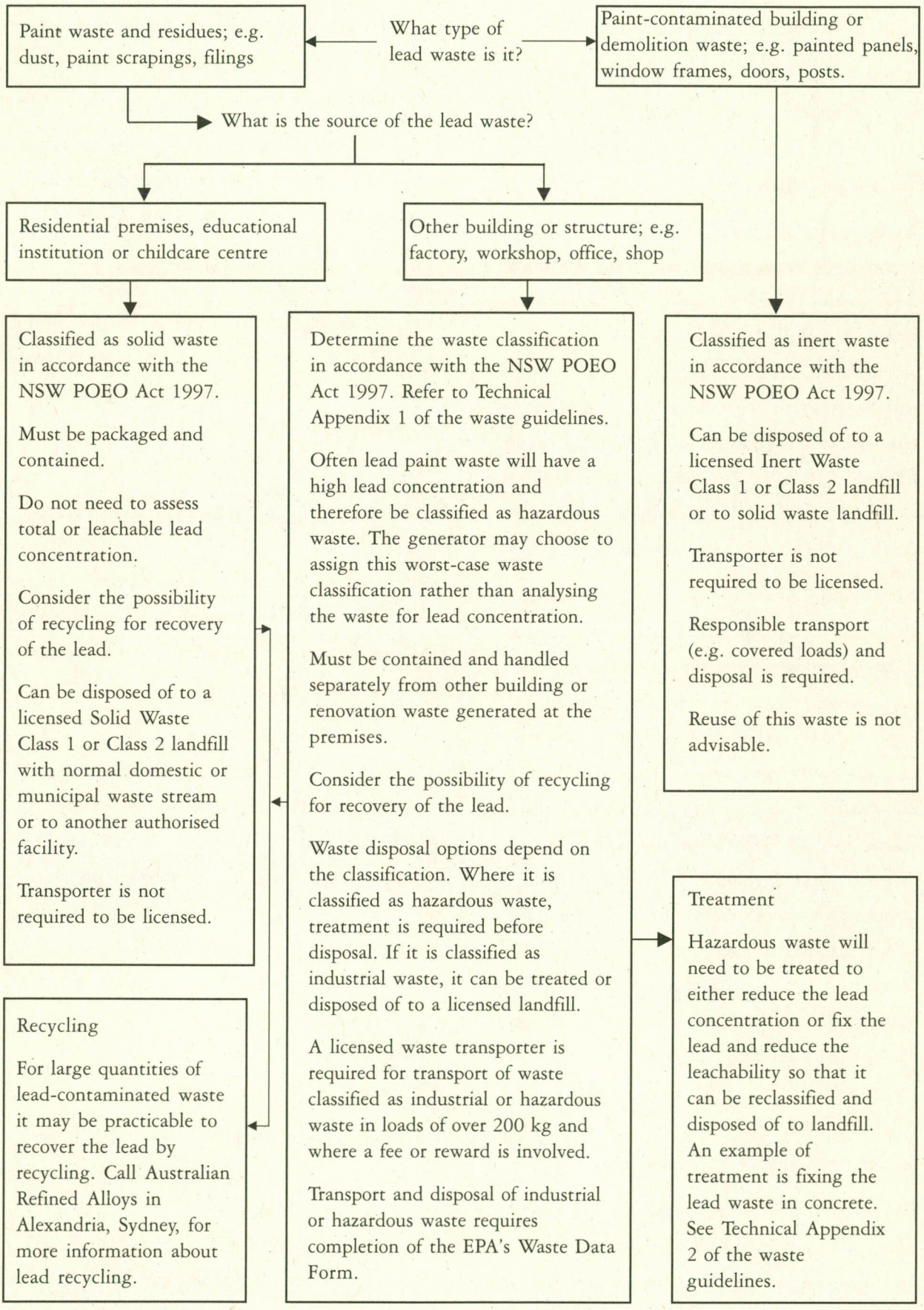
Technical note 5: Waste management

The flow diagram (Figure 2) provides a quick reference to the waste management requirements for typical solid wastes from maintenance, renovation and demolition of lead-contaminated premises.

It is the primary responsibility of the waste generator to classify the wastes, use a licensed transporter where necessary and ensure that the wastes are taken to a suitable waste facility. Therefore the generator must also refer to the *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes* (the waste guidelines) (EPA 1999). Copies are available from the EPA's Pollution Line on 131 555 or the EPA's website at http://www.epa.nsw.gov.au/waste.

Management of liquid lead-contaminated wastes (such as waste from abrasive wet blasting or chemical stripping) is not covered in the flow diagram. Generators of liquid wastes need to refer to the waste guidelines for appropriate classification, handling and disposal. Depending on the quality, liquid wastes may be discharged to the sewer with the prior approval of the local sewerage authority or council. Licensed liquid waste treatment facilities can also offer advice.

Figure 2. Solid waste contaminated with lead



Technical note 6: Lead management plan scenarios

1) 1/5 River St, Hometown

Activity: Change location of kitchen in a 1940 stone and timber home. Demolish external walls, alter roofline, add new skylight, install new kitchen and repaint.

Assessing the property for lead: Being over 50 years old, the building will have lead paint on the walls and lead-contaminated dust in wall cavities and in the ceiling. No testing was carried out as it was assumed that lead was present. Not all work will create potential lead hazards, but all work will comply with the council's DCP, Australian Standard AS 4361.2, *Lead Safe: A Renovator's Guide to the Dangers of Lead* (EPA 1998) and *Code of Practice for Control of Workplace Hazardous Substances* (WorkCover NSW 1996).

Preparation of site: Access to the site will be restricted to workers wearing appropriate personal protective equipment at all times: an approved (Australian Standard AS 1716) half-face respirator mask with a P1 (dust) or P2 (dust and fumes) protection rating. Disposable clothing will be used. All soft furnishings, curtains, carpets, rugs and other household items will be removed from work areas. Other items will be wrapped in plastic sheeting. Where possible, ceiling spaces will be vacuumed with a HEPA vacuum cleaner before work begins. Plastic drop sheets large enough to catch debris and dust will be placed under the work area and taped to adjoining walls. Plastic taped to doors, windows and hallway entrances will close off the area.

Demolition of wall: All surfaces will be kept wet during demolition, and drop sheets will cover all areas on which dust and debris are likely to fall. Hand-demolition only will be carried out. All doors and windows will remained closed while the walls are being demolished, and all removed materials will be placed in a skip that remains covered at all times. Materials will be damped down before removal from the house to reduce dispersion of lead dust.

Wet cloths will be used to collect paint chips and debris. All loose debris will be misted and bagged. All waste will be placed in a disposal bag in the contaminated area to prevent the spread of lead paint dust or other waste to clean areas. All loose paint fragments on the remaining wall will be removed with a scraper until no loose paint remains along the edges. The edges will be wet-sanded to smooth them and the surfaces if needed.

Repainting: All existing paint will be painted over except where it is peeling and flaking. The peeling and flaking paint will be removed by misting the area, wet-scraping, wet-sanding and cleaning the surface. Surface preparation will be kept to a minimum.

Clean-up of work area: Clean-up will be done by working from the cleanest point to the dirtiest, and from the highest point down to the walls, rails, skirting boards and floors. Wet-wiping (rinsing all surfaces) and wet-mopping procedures (including the three-bucket method) will be used. One cloth will be used to wet-wash the entire work area where dust may have settled, using sugar soap or a phosphate detergent. Another cloth will be used to remove the sugar soap, and a third will be used to clean the rinsed area.

A HEPA vacuum cleaner will be used to clean up accumulated dust. The drop sheet and floor will be wiped off with a rag or mop and rinsed with another rag or mop with clean water. Surfaces where dust or debris is present will be wet-cleaned or mopped.

Removal of waste: All waste will be placed in a disposal bag or container and sealed. Bags will be placed in the covered skip or bins. Lead-contaminated waste from a residential dwelling is classified as solid waste and may be disposed of to a licensed Solid Waste Class 1 or 2 landfill. Drop cloths will be rolled inward and placed in disposal bags with other lead waste.

2) Hometown Preschool

Activity: Lead paint removal.

- All work will be done outside normal school hours.
- Paint will be removed by compressed air sanding machines with a vacuum attached for the continuous extraction of dust through a HEPA filter, which reduces exposure levels to less than 50 $\mu g/m^3$ and action levels to less than 30 $\mu g/m^3$. Work areas will be wetted down before the sanding machines are used.
- The entire ground area will be plastic-sheeted to catch any other debris and contain it in the work area. At the end of each shift, the ground sheet will be folded up with the debris inside, including any disposable sanding paper, and taped up for storage before disposal.
- Any water generated in the wetting-down of the areas will be sucked up with a wet vac or bilge pump, stored in drums and removed to a suitable dump site.
- In areas where the work cannot be wetted down in safety, it will be scaffolded up to allow encapsulation. Before removal for cleaning up, all scaffolding will have all dust and debris removed by vacuuming off and washing down with clean water, then it will be taken away from the job area.
- All tools will be cleaned each time work is completed for the day, and either wet-wiped or vacuumed with a HEPA system. Tools should be securely stored where they cannot cause contamination until next required.
- No work will be carried out in unsuitable weather conditions (e.g. high winds) that may cause excess exposure on- or off-site.
- All work surfaces will be wiped clean with a wet cloth before any sealer coat is applied. All cloths will be sealed in plastic bags for removal to a suitable dump site.
- All workers and contractors involved in the work will be supplied with protective overalls, gloves, goggles, shoe covers and dust masks that meet Australian Standard AS 1716. At the end of each shift, these items will be either cleaned separately or sealed in plastic bags, placed in a safe area and stored before removal.
- All staff will be instructed in all aspects of safety in the removal and containment of lead, including self-hygiene and the correct handling of tools, clothing and waste.
- In the event of any spill, the entire area will be sealed off, and all contaminated areas will be cleaned up. The waste will be sealed in plastic bags and disposed of according to requirements.
- All work areas will be taped off with a buffer of at least 10 metres. Only authorised persons in safety gear will have access to the area.
- Lead paint waste will be securely contained, labelled and stored away from any access by children. Lead-contaminated waste from a preschool is classified as solid waste and may be disposed of to a licensed Solid Waste Class 1 or 2 landfill.

Technical note 7: Publications and standards

Statutory

Environment Planning and Assessment Act 1979

Local Government Act 1993

Protection of the Environment Operations Act 1997

Waste Avoidance and Resource Recovery Act 2001

Contaminated land

Contaminated Land Management Act 1997

Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land (1995), NSW EPA

Contaminated Sites: Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report (1999), NSW EPA

Managing Land Contamination: Planning Guidelines (1998), DUAP/EPA

Olszowy H, Torr P, Imray P. *Trace Element concentrations in Soils from Rural and Urban Areas of Australia* (1995), South Australian Health Commission and Commonwealth Environment Protection Agency (Contaminated Sites Monograph Series No. 4, 1995).

State Environmental Planning Policy No. 55—Remediation of Land (1998), DUAP

Lead education materials (call EPA Pollution Line on 131 555 for copies)

Lead Safe: A Guide for Health Care Professionals (1997), NSW EPA

Lead Safe: A Guide to Keeping Your Family Safe from Lead (1997), NSW EPA

Lead Safe: A Renovator's Guide to the Dangers of Lead (1998), NSW EPA

Lead Safe Fact Sheets: 'Old Lead Paint', 'Lead in Ceiling Dust', 'Lead-Safe Housekeeping', 'Lead and Home Renovations', and 'Lead: Your Health and the Environment'. (Accompanying fact sheets in Korean, Vietnamese, Arabic, Chinese, Turkish, Macedonian and Spanish.)

A Six-Step Guide to Painting Your Home (1999), Environment Australia, Community Information Unit (1800 803 772).

Occupational health and safety (contact WorkCover NSW for copies)

Code of Practice for the Control of Workplace Hazardous Substances (1996), WorkCover NSW

National Standard for the Control of Inorganic Lead at Work [NOHSC:1012(1994)], National Occupational Health and Safety Commission

National Code of Practice for the Control of Workplace Hazardous Substances [NOHSC:2007(1994)], National Occupational Health and Safety Commission

Occupational Health and Safety (Hazardous Substances) Regulation 1996

Australian standards (contact Standards Australia on 8206 6000 for copies)

AS 2601, 1991—The Demolition of Structures

AS 4361.1, 1995—Abrasive Blasting

AS 4361.1, 1995—Guide to Lead Paint Management, Part 1: Industrial Applications

AS 4361.2, 1998—Guide to Lead Paint Management, Part 2: Residential and Commercial Buildings

AS 4482.1, 1997—Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds

Standards for personal protective equipment (contact Standards Australia on 8206 6000 for copies)

Clothing—AS 3765

Eye protection—AS 1337 and AS 1336

Head and foot protection—AS 1801, AS 1800 and AS 2210

Respirator—AS 1716. Minimum P1 rating for dust and P2 rating for dust and fumes

Selection, use and maintenance of personal protective equipment—AS 1715

Roads

Traffic Volume Data for Sydney Region (1993), Roads and Traffic Authority of NSW

Waste (call EPA Pollution Line on 131 555 for copies)

Construction and Demolition Waste Action Plan (1998), NSW EPA

Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-Liquid Wastes (1999), EPA

Regulation (call EPA Pollution Line on 131 555 for copies)

Guide to Licensing under the POEO Act 1997, Part A and Part B (1999), NSW EPA

Guide to Notices under POEO 1997—Environment Protection Manual for Authorised Officers (1998), NSW EPA

POEO Guidance Document: www.lgsa.org.au

Appendix 1: Model development control plan for lead contamination

1. Introduction

1.1 Citation

This document may be cited as _____ Council Development Control Plan—Management of Lead Contamination.

1.2 Responsible authority

The authority responsible for enforcing compliance with this development control plan (DCP) is _____ Council.

1.3 Land to which the plan applies

This plan applies to all land within the _____ Council area.

1.4 Relationship to other regulations, instruments and policies

This plan supplements any relevant planning instrument applying to the land within the _____ Council area, and any other relevant council plans, codes and policies.

1.5 Aims and objectives

The aim of the plan is to minimise lead exposure to the public and lead pollution in the environment by requiring lead-safe work practices and controls and proper disposal procedures during development activities. More specifically, the objectives of the plan are to:

1. ensure that all development and activities comply with acceptable environmental planning practices and standards
2. assist in achieving a consistent approach to the management of lead contamination
3. minimise the overall environmental impacts of lead contamination
4. minimise the effects of lead on the health of residents
5. provide advice to people and organisations on how to manage lead in their premises and the environment, matters that need to be considered and the actions to be carried out
6. provide advice to intending applicants on how to reduce and handle waste during the demolition and construction phases
7. provide for continuing control of lead in premises
8. provide guidance for the council in undertaking its infrastructure management and maintenance functions.

2. General requirements

These requirements apply to any activity associated with development where there may be a lead hazard or risk. Some types of developments and activities will require a lead management plan (LMP) to be submitted to the council (or the Minister for Planning in the case of state significant development). State significant development would need to comply at a minimum with all requirements relating to local development.

2.1 Lead risk circumstances

Table A outlines possible lead risk circumstances. If the answer to any of questions 1 to 6 in the table is yes, the proponent or developer will need to elaborate further by answering questions 7 to

15. This process should help the council assess activities having a lead risk potential and identify which of those activities require an LMP. Where applicants are unable to answer questions owing to a lack of information, council records and local knowledge should be consulted. For information about methods of assessing lead contamination, consult Technical Note 2.

For exempt developments, the onus is on the person engaged in the activity to demonstrate to the council that the activity is being carried out in a manner consistent with the requirements of this DCP. Developers should check with the council about best-practice methods (see Technical Notes 2 to 5).

Table A. Lead risk assessment and checklist

Answer questions 1–6

1. Is the proposed development or activity near a major road or traffic intersection (> 20 000 vehicles per day; RTA 1993) that has existed for more than 15 years?

☐Yes ☐No

2. Is the proposed development or activity near a point source for lead contamination (e.g. mine, smelter, an industry using lead in processing)? See Technical Note 3.

☐Yes ☐No

3. Could the previous land use activities have contaminated the site with lead, e.g. rifle range, printing, pigment production, lead sinker production? See Technical Note 3.

☐Yes ☐No

a) Is the development or activity on or within 50 metres of land that was previously used or continues to be used for industrial purposes (e.g. metal fabrication, galvanising, panel beating)?

☐Yes ☐No

4. Has the site been landfilled at any time or been used for an activity likely to have caused lead contamination (e.g. slag, orchards or market gardens that may have used lead arsenate)?

☐Yes ☐No

5. Are there any other residential dwellings, schools or preschools, hospitals or nursing homes within 50 metres of the proposed development or activity? If yes, answer Q6 to Q15.

☐Yes ☐No

6. Is there any existing building or structure within the proposed development or activity site built and/or painted before 1970? If yes, go to Q7.

☐Yes ☐No

7. Indicate whether the proposed development or activity includes demolishing (in part or in full) any of the following:

☐ kitchen

☐ bathroom

☐ laundry

☐ water tanks

☐ masonry or timber walls that are painted

☐ other (please specify)

8. Indicate whether the proposed development or activity involves replacing or removing paintwork from any of the following **external** features:

☐ walls (including dampcourse)

☐ windows (including flashing)

☐ doors

9. Will the proposed development or activity involve exposing any part of the roof and ceiling cavity or wall cavities? ☐Yes ☐No

10. Indicate whether the proposed development or activity includes replacing or removing paintwork from any of the following **internal** features:

☐ walls and skirtings

☐ windows

☐ doors

☐ ceilings and cornices

☐ fixtures such as architraves, balustrades and stair treads

11. If you ticked boxes in either questions 8 or 10, will the proposed paint removal process involve dry abrasive blasting, wet blasting, heat application or power tools? ☐Yes ☐No

12. Will the proposed activity involve removal or replacement of roof gutters or downpipes installed before 1970? ☐Yes ☐No

13. Will the proposed activity involve removal or replacement of plumbing fittings or waterproofing linings? ☐Yes ☐No

14. Will the proposed activity involve removing old carpet or floorboards? ☐Yes ☐No

15. Will the proposed activity involve disturbing soil underneath the house or verandah? ☐Yes ☐No

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Note: If there is not enough information to answer a question but there is a reasonable chance that the conditions apply, use the precautionary principle.

The onus is on the developer or proponent to identify the potential lead risks in their proposal. This questionnaire is an example only and is by no means exhaustive. It is included for consideration and adaptation as required.

Councils will need to develop a methodology to assess the lead risk and so determine whether an LMP is required. An LMP requirement may be triggered by a single 'yes' answer, for example.

For activities triggering an LMP, educational material could also be provided to the developer or proponent. If an LMP is not required, the developer or proponent will still need to act in a manner consistent with the DCP.

2.2 Lead management plan

Depending on responses to the lead risk assessment, councils may require an LMP. The information required for a LMP may be included in an environmental impact assessment.

In straightforward situations where no sensitive populations are likely to be affected, an owner or developer could prepare a LMP themselves by following the guidance in *Lead Safe: A Renovator's Guide to the Dangers of Lead* (EPA 1998) and in Technical Notes 2, 4 and 6. For more complex situations, the person preparing the LMP will need to satisfy the council that they are appropriately qualified and experienced in lead assessment or similar environmental and building hazards.

An LMP should provide council with the following details:

- history of any relevant structures, buildings, land or industries
- details regarding any testing that has been carried out to ascertain the extent of lead contamination
- type and estimated amount of lead contamination (internal/external lead paint, lead dust in ceiling or wall cavities, contaminated soil, slag or fill)
- how the lead is to be controlled or removed
- how the contaminated waste will be classified, handled, transported and disposed of
- description of how the environmental and health risks of the proposal will be minimised (including occupational health and safety precautions)
- procedure for verification to the council that the work has been completed appropriately.

3. Specific requirements

The following sections relate to specified activities (renovation or refurbishment, demolition, landscaping, landfilling). These activities may require approval in their own right or they may be part of broader activities that require approval.

The need for an LMP is determined in Section 2 of this plan. An LMP must be submitted with a development application.

An LMP should demonstrate that preventive and remedial measures will be taken that are consistent with the advice below.

Where development approval is not required (e.g. exempt development), the person carrying out the activity may be required to demonstrate that the activity is being carried out in a manner consistent with the advice below.

A checklist to identify lead risks is included in Section 2 above.

3.1 Renovation and refurbishment

Lead paint and dust

Intact lead paint in good condition poses no hazard. Lead paint becomes dangerous when it peels, chalks, begins to flake or is disturbed. When it is disturbed by renovation, workers, children and pets are exposed. Fine paint and dust can be breathed in or can contaminate the house, its contents and the surrounding area. Many of the hazards of renovation can be minimised by taking the right precautions and using the right equipment.

Lead-contaminated dust is often found in ceilings and wall voids. Lead dust becomes dangerous when disturbed and is better left untouched. The dust in the roof void does not pose a danger if ceilings, cornices and ceiling roses are in good repair. Black trails of dust near cracks or cornices are trouble signs. Decorative ceiling roses with air vents can also let dust in.

Some home and building maintenance or renovation activities may disturb paint or dust and increase the risk of contamination of living areas. These include:

- demolishing ceilings or walls
- adding a second storey extension
- putting in an attic ladder or skylight
- renovating or refurbishing painted areas or ceilings.

Hazards from paint and dust can be minimised if renovation is undertaken only when it is absolutely necessary—and then by doing it safely. Simple measures can be taken during renovations to protect workers and residents:

- Paint only if a surface is not in good condition (peeling, flaking or chalking), and do not remove old paint unless it is necessary (paint over it if it is in good condition).
- Hire a contractor to vacuum ceilings to minimise the spread of dust when ceiling work is planned.
- Move out during renovations (particularly children and pregnant women).
- Advise neighbours in good time when you plan to start renovation or demolition so they can make plans to leave the house for the day, or at least take measures such as closing windows and keeping children away from the work area.
- Remove or cover all soft furnishings and carpets to prevent contamination.
- Wash hands and face before meals.
- Shower and change when work is finished. Place contaminated clothes in a clean polyethylene bag before removing them from the work area, as they are a significant source of contamination to others.
- Wash work clothes separately from all other clothes, and rinse the washing machine afterwards.
- Do not smoke or carry cigarettes in the work area (you may breathe in the lead dust that settles on them).

Painting or removing lead paint

Any paint containing lead on residential and commercial buildings must be managed in accordance with Australian Standard AS 4361.2, 1998—Guide to Lead Paint Management, Part 2: Residential and Commercial Buildings without causing any environmental contamination. It may also be useful to follow this guide when removing lead paint in other situations, for example, playground equipment. Hire a professional experienced in lead-safe work to remove lead-based paints and test for dust clearance, particularly in public and commercial buildings that remain open during renovations.

Removal of lead paint and protective coatings by methods such as abrasive blasting from larger buildings and industrial infrastructure where lead-based coatings continued to be used must be done in accordance with Australian Standard AS 4361.1, 1995—Guide to Lead Paint Management, Part 1: Industrial Applications.

Preparing the work area

- Plan the renovation to separate and reduce waste, recycle building materials and reduce any disposal costs.
- **Outside**—Lay plastic sheeting under and around the work area to contain debris. Close windows and doors.

- **Inside**—Seal the work area off from the rest of the house and outside by covering floors, doors and windows with plastic and tape. Remove soft furnishings, curtains, carpets and other household items or cover them with plastic.

Equipment and practices

- Power sanders, heat guns, blow torches, sand blasting, water guns or any other methods that distribute paint dust or flakes into the surrounding environment must not be used for the removal of leaded paint unless adequate protection and containment measures are taken. More information on these measures can be found in Technical Note 4.
- Wet sanding and wet scraping are the safest methods of preparing the surface.
- All paint debris, including dust and flakes, must be collected and safely disposed of in a sealed container. No paint dust or flakes should be allowed to pollute the inside or outside environment.
- Domestic vacuum cleaners must **not** be used, as they distribute leaded paint dust in the form of fine particles. Use a vacuum cleaner with a high-efficiency particulate air (HEPA) filter.
- All workers must wear an approved (Australian Standard AS 1716) respirator fitted with P1 (dust) or P2 (dust and fumes) filters, and coveralls to prevent exposure to lead dust and fumes. Paper filters offer no protection from fine dust.
- Wear protective clothing (long sleeves and pants) that does not catch dust or flakes in pockets or cuffs (or disposable overalls and plastic boots).
- Follow manufacturers' instructions exactly if solvents or caustic chemical strippers are being used.

Cleaning up

- Clean equipment thoroughly of dust and paint fragments before it leaves the work area. Cleaning with a HEPA filter vacuum cleaner followed by a wet wipe is normally sufficient.
- Do not sweep—wet-wash the entire area with a detergent, such as liquid soap, and rinse with clean water.
- Where children will reoccupy the premises, consider having a clearance test to ensure that lead paint and dust have been thoroughly removed.

Waste disposal

- A flow diagram in Technical Note 5 outlines some steps for classifying and managing lead-contaminated waste.
- Contact your local council or waste service provider to find out about services, disposal facilities and fees. The EPA's *Environmental Guidelines; Assessment, Classification and Management of Liquid and Non-Liquid Waste* (the waste guidelines) is the primary reference for waste management requirements in NSW.
- Appropriate containment measures are essential in properly managing lead waste. Lead dust needs to be meticulously collected, securely contained and labelled.
- Waste contaminated with lead originating from **domestic premises, educational and childcare institutions** is classified as solid waste in Schedule 1 of the POEO Act and

can be disposed of in a Solid Waste Class 1 or 2 landfill.

- Waste that is classified as **industrial or hazardous waste** according to the waste guidelines or Schedule 1 of POEO Act has special transporting and disposal restrictions. In particular, hazardous waste requires treatment before landfill disposal, as no landfills in NSW are permitted to accept this type of waste. It is your responsibility to classify the waste properly, to use a licensed transporter if necessary, and to ensure the waste is recycled or disposed of at an appropriate facility.
- Where there is enough lead-contaminated waste and the transportation is practicable, recovery of the lead through recycling is recommended over disposal to landfill.
- Waste transporters who transport industrial, hazardous or Group A waste for a fee or reward in quantities of more than 200 kg are required to a hold waste transporter's licence.
- For disposal of industrial waste, hazardous waste and Group A waste you must obtain a consignment authorisation number from a waste facility, complete a Waste Data Form and provide copies to the transporter.
- Schedule 1 of the POEO Act outlines activities that require an environment protection licence issued by the EPA. A licence for 'waste activities' is required for industrial, hazardous or Group A waste generation or storage (subject to exemptions for certain activities and waste quantities). For example, a painter does not require a waste activity licence if he or she generates less than 10 tonnes per year or stores less than 2 tonnes at any time. Refer to the waste guidelines and the EPA's 1999 *Guide to Licensing under the Protection of the Environment Operations Act* for further information.
- Where you do not need to hold an environment protection licence under the POEO Act, you must still comply with the requirements of the POEO Act.

Removing lead dust

- Do-it-yourself removal of lead dust, particularly from ceiling cavities, is not recommended, as it is dangerous and requires the use of special equipment such as HEPA vacuum cleaners. Hire a professional experienced in lead-safe work to remove ceiling dust.

Preparing the work area

- Develop a simple work plan to help do the job safely, reduce waste and save time and money.
- Ensure that dust does not enter living areas through the access hole into the ceiling by laying plastic sheeting under the access hole and moving soft furnishings, curtains, carpets and other household items or covering them with plastic.

Equipment and practices

- All workers must wear an approved (Australian Standard AS 1716) respirator fitted with P1 (dust) or P2 (dust and fumes) filters, and coveralls to prevent exposure to lead dust and fumes. Paper filters offer no protection from fine dust.
- Wear protective clothing (long sleeves and pants) that does not catch dust or flakes in pockets or cuffs (or disposable overalls and plastic boots).
- If vacuuming, use a HEPA vacuum cleaner.

Cleaning up

- Do not sweep—wet-wash the work area and nearby living areas with a detergent, such as liquid soap, and rinse with clean water.
- Where children will reoccupy the premises, consider having a clearance test to ensure that dust has been thoroughly removed.

Waste disposal

- The same criteria apply as for 'Painting or Removing Lead Paint' above.

3.2 Demolition

Lead paint and dust

Demolition of buildings and building components can disturb lead paint and dust and release it into living areas and the outside environment. WorkCover NSW has regulations regarding demolitions. Check these if you are undertaking demolition.

Preparing the work area

- Prepare a work plan in accordance with the requirements of Australian Standard AS 2601, 1991, The Demolition of Structures, and submit it to the council or an accredited certifier for consideration.
- Use fine-mesh dust-proof screens to contain work areas, wet lead-safe work practices or other appropriate containment measures to prevent hazardous dust from escaping the site or contaminating the immediate environment.

Equipment and practices

- All contractors and employees directly involved in the removal of hazardous dusts and substances must wear personal protective equipment (see Technical Note 7).
- All contractors and employees directly involved in the removal of hazardous dusts and substances must adopt work practices in accordance with the National Occupational Health and Safety Commission requirements and Australian Standard AS 2641, 1998.
- Any existing accumulations of dust (in ceiling voids and wall cavities) must be removed with an industrial vacuum fitted with a HEPA filter and disposed of appropriately.
- Suppress all dust on surfaces, in building cavities and created by work by a fine water spray or misting. Runoff must not be allowed to enter the street gutter or stormwater drainage.
- Do not undertake demolition work during high winds that might cause dust to spread beyond the site boundaries.

Waste disposal

- The same criteria apply as for 'Painting or Removing Lead Paint' above.
- Construction and demolition waste, particularly timber, bricks, tiles and concrete, need not be disposed of—they can be recycled and resold if segregated properly from hazardous waste contamination. See Technical Note 5 for further information.

3.3 Landscaping and filling

Land contamination (see Technical Note 1)

Land can be contaminated from a number of sources or from activities that took place on or near it. Lead deposited in soil remains there, so even if the activity generating the lead has ended, the lead in the soil will remain unless it is removed and could be a source of exposure unless covered.

Depending on a number of factors, including whether levels constitute a 'significant risk of harm' and council policy, it may be possible to leave the soil in place and manage it. A number of management strategies are listed below.

Preventive or hazard reduction strategies

- Keep soil contamination levels low by preventing contamination from renovation or other activities.
- Establish an effective ground cover and reduce the hazard of windblown contaminated soil.
- Reduce the hazard of contaminated soil by adding 'soil amendments'—organic material and certain fertilisers—that can bind lead and reduce its uptake by plants or exposed children or pets.
- Remove and dispose of contaminated soil and replace the top layer (8 to 15 cm) with clean topsoil and organic material such as leaf litter.
- Pave or concrete the area to isolate contaminated soil from human contact. Ask the council about noting information on property files regarding the existence of lead contamination beneath paving, concrete or buildings.
- Reduce the hazard of contaminated soil by 'roto-tilling' (mixing the top layer of soil with the deeper soil, which should be less contaminated with lead). This is suitable only for low lead levels and only at the surface, and can be done only once. See *Contaminated Sites: Guidelines for the Vertical Mixing of Soil on Former Broad-Acre Agricultural Land* (NSW EPA 1995).

Hazard reduction work practices

- Reduce the spreading of dust and lead by wetting the soil and equipment before working.
- Ensure that residents, especially children, are away from the area.
- Eat, drink and smoke away from the work area.
- Change outer clothing and shoes before entering the house.

Definitions and abbreviations

accredited certifier	A person who is accredited to approve the design or construction of complying development under the *Environmental Planning and Assessment Act 1979* as amended
DCP	Development control plan
EPA	NSW Environment Protection Authority
hazardous dust	A dust containing not less than 0.5% by weight (WorkCover NSW). Dust lead levels exceeding 1000 ppm (0.1%) can pose health risks to young children (NSW Health)
HEPA	High-efficiency particulate air filter or vacuum cleaner with filter
LMP	Lead Management Plan
LRC	Lead Reference Centre
lead level	The concentration of lead found in paint, dust or soil
lead paint	A paint containing not less than 1% by weight of the dry film. See Technical Note 3
lead poisoning	Under the *Public Health Act 1996*, blood lead test results above 15 μg/dL (0.72 μmol/L) in children and adults are defined as the notifiable level of lead poisoning
NHMRC	National Health and Medical Research Council
plan	This model development control plan
PlanningNSW	Formerly known as Department of Urban Affairs and Planning
POEO Act	*Protection of the Environment Operations Act 1997*
significant risk of harm	Refers to the status of a site where the contamination is considered serious and requires EPA regulatory intervention. See *Guidelines on Significant Risk of Harm from Contaminated Land and the Duty to Report* (EPA 1999)

units of measurement

Blood lead levels: Modern laboratory practice expresses blood lead levels in micromoles per litre (μmol/L). However, as the formerly used units of micrograms per decilitre (μg/dL) appear to have been used more commonly in international medical literature, this document uses μg/dL.1 μmol/L = 20.7 μg/dL; 1 μg/dL = 0.0483 μmol/L

Environmental samples: Expressed as milligrams per kilogram (mg/kg) = parts per million (ppm) = micrograms per gram (μg/g). Particle size: micrometre (μm) or micron = 1/1 000 000 of a metre or 1/1000 of a millimetre

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