LEAD-BASED PAINT MANAGEMENT ON ROADING STRUCTURES

SECTION III GUIDELINES

Transfund New Zealand Research Report 115

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GUIDELINES

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AN IMPORTANT NOTE FOR THE READER

The research detailed in this report was commissioned by Transfund New Zealand.

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EXECUTIVE SUMMARY

This is Section III of a report on a research project that had the objective to develop "environmental and health and safety guidelines, procedures and policies for the management and risk assessment of lead-based paint coatings on bridges and other roading structures in order to minimise the adverse impacts on the environment and thus to provide a consistent approach nationwide".

This document, *Section III Guidelines,* provides information for owners of roading structures and maintenance engineers, consultants and contractors. It will assist them to utilise the risk management process outlined in AS 4361.1 and so identify the most cost-effective maintenance strategy while minimising environmental, and health and safety risks during the maintenance work.

Section I (Transfund Report 113) contains the results of a nationwide survey of road controlling authorities. This found a wide variation in the level of knowledge about the extent of lead-based paint on highway structures. From the data supplied it has been estimated that there are approximately 2300 road and state highway bridges in New Zealand with major steel components that may be protected with lead-based paint. With these bridges there is a potential for adverse impacts on the environment and public health to occur during maintenance painting.

Regional Councils who issue resource consents for the cleaning and painting of road structures coated with lead-based paint were also surveyed. This survey found that the conditions of consent imposed by Regional Council's varied widely, and that the standards required were often non-specific and not as rigorous as those required by AS 4361.1 and regulatory authorities both in Australia and the United States. The potential liabilities of owners of these structures and managers of maintenance work under the Resource Management Act 1991 (RMA) and Health and Safety in Employment 1992 (HSE) Act are discussed.

Section I Appendix 4 contains a *Model Policy Statement for Removal of Lead-based Paint* which is recommended for adoption by owners of these structures to minimise potential detrimental effects both to the environment and to their contractors. This will assist the owners of bridges and other roading structures to meet their statutory obligations with respect to paint removal projects.

Section II (Transfund Report 114) is a *Code of Conduct for Contractors.* This is a plain language guideline for contractors who undertake maintenance of roading structures containing lead-based paints, which will help them meet their legal requirements under the RMA and HSE Act.

Section IV (Transfund Report 116) contains a *Model Specification for the Cleaning and Coating of Steelwork.* This is a generic standard specification that can be used as a base document for a steelwork maintenance contract where lead-based paint is to be removed, and which sets out information to be supplied by the owner, and requirements to be met by the Contractor.

Guidance is given on the selection and specification of coating systems, and requirements covering the safety of contractors and the public, environmental protection, monitoring and inspection of the work are recommended. Also included are standards for paint materials, surface preparation and containment structures where required for lead abatement.

ABSTRACT

This report is Section III of four "stand alone" documents that can be used by road controlling authorities, maintenance engineers, and industrial painting contractors when carrying out removal or maintenance of lead-based paints on steel roading structures to comply with their statutory obligations and minimise effects on the environment, and risks to workers and public health. This document contains guidelines for structure owners, maintenance engineers, consultants and contractors. It will assist them to identify the most cost-effective maintenance strategy while minimising environmental, and health and safety risks during the maintenance work.

1. INTRODUCTION

Until the mid-1950s the standard primer for the corrosion protection of steel roading structures was a mixture of red lead in linseed oil. As faster drying alkyd resins became available the original formulation was replaced by an oil/alkyd red lead paint and then in the 1970's lead-based primers were superseded by zinc chromate and zinc silicate primers.

The end result is the existence of many steel bridges that have been coated with lead-based primers. Historically when maintenance is required, the most efficient means of preparing the steelwork for repainting has been by abrasive blasting. However lead contaminated dust emissions present a health risk to workers and other persons in the vicinity of the operations. In addition lead paint flakes removed during blasting can result in the significant contamination of soils and adjacent waterways if strict containment measures are not followed.

OSH introduced a publication titled "Guidelines for the Management of Lead-Based Paints" in June 1995. The aim of this document was to provide guidance on the safe removal of lead-based paints from the interior and exterior of occupied buildings. It does not specifically address removal from structural steelwork, such as bridges.

In December 1995 the Australian Standard AS 4361.1-1995 *Guide to Lead Paint Management-Part 1: Industrial Applications* was introduced. This document was originally developed for the Roads and Traffic Authority of New South Wales and is derived from documents prepared for the Steel Structures Painting Council (SSPC) based in Pittsburgh, USA. This Standard is a useful guide for lead management practices on bridges but was orientated towards Australian codes and standards.

As a result Transfund commissioned this document which aims to apply the concepts of risk management contained in AS 4361.1 to the New Zealand situation. These guidelines take into account New Zealand's regulatory environment and in particular the requirements of the Resource Management Act 1991 and the Health and Safety in Employment Act 1992.

The main objective of these guidelines is to assist Transit New Zealand, Local Authorities, project consultants and maintenance painting contractors to utilise a risk management process that will identify the most cost-effective paint management strategy for roading structures whilst minimising environmental, and health and safety risks. Under these guidelines the sensitivity of the surrounding area in both environmental and public health terms is a key factor in determining both the most appropriate paint maintenance methods to be used and the risk mitigation measures required.

2. SCOPE AND APPLICATION OF GUIDELINES

2.1 Scope of this Guideline

The scope of this guideline is to describe an effective approach for minimising the risks from lead to contractors, the general public and the environment during maintenance operations on roading structures containing lead-based paints. Although essentially written to assist controlling authorities, this document will also assist Regional Council's and contractors.

Whilst this guideline is specifically targeted at minimising the risks to health and the environment from lead, the procedures followed should ensure there is minimal impact from other toxic materials (e.g. chromates) used in coatings for roading structures.

This guideline document draws heavily on the risk assessment and lead paint management methods outlined in Australian Standard 4361 Part 1*: Guide to Lead Paint Management- Industrial Applications* but has been tailored to fit the New Zealand regulatory situation.

2.2 Application

This guideline does not address the removal of lead-based paint from buildings. *The Guidelines for the Management of Lead-Based Paints* produced by Occupational Safety and Health Service of the Department of Labour (OSH) and the Public Health Commission in 1995 provide guidelines for lead paint removal in these situations as does AS 4361.2.

This guideline does not specifically address the removal of lead from other industrial structures although most of the principles outlined are applicable to other industrial lead paint removal operations.

3. THE HAZARDS OF LEAD-BASED PAINT

3.1 The Toxicity of Lead

Lead is both a poison and an environmental pollutant, yet is widely distributed throughout the built and natural environment. Lead in any form is highly toxic to humans when ingested or inhaled. Typically, maintenance of structural steel work on bridges in the past has involved the use of abrasive blasting or mechanical grinding which has the effect of pulverising the paint into small particles that can readily be inhaled or ingested. Repeated intake of lead dust may result in lead poisoning.

The early stages of lead poisoning are non-specific and affect the gastrointestinal and nervous system. In later stages, symptoms may develop in the blood, kidneys, bones, heart and reproductive system, and may in extreme cases result in death.

The general state of health may influence the severity of symptoms, as lead already in the body may be mobilised during pregnancy or due to health upsets, infections or excessive alcohol consumption. One of the worst results of lead exposure is the retarding of intellectual development in children.

3.2 Particular Risks for Young Children

The primary exposure for children is by ingestion of contaminated dust, soil or paint fragments. Pre-school children are particularly susceptible to poisoning from lead-based paint because:

- They may play on surfaces that contain contaminated dust, and transfer the contamination from hand to mouth.
- They may chew items containing lead-based paints.
- They may eat lead-contaminated material such as paint fragments or soil (a behaviour known as pica).
- Their small body mass means that even tiny amounts of lead can cause poisoning.
- They absorb proportionally more lead from their gastro-intestinal tract than adults.

Most children suffering from elevated lead levels have no clear symptoms. The effect of mildly elevated lead levels can include reduced IQ, increased school failure, impaired neuro-behavioural development, cognitive deficits, irritability and aggression. In the U.S.A, lead is now regarded as the biggest environmental health threat to children under six years of age.

3.3 Routes of Exposure

Poorly screened abrasive blasting operations can directly expose other workers and bystanders to lead contaminated dust that can be directly inhaled.

In addition, preparation methods that result in the uncontrolled release of lead paint flakes and contaminated abrasive into the environment, leading to the contamination of soil, footpaths, streets and waterways. Drinking water and recreational waterways can be polluted, fisheries, garden and farm produce can be contaminated and affected soil can be picked up on shoes, and tracked into houses and buildings. This may result in a prolonged exposure to a low level of lead contamination. As lead is an insidious poison which can buildup in the body this may eventually result in adverse health effects particularly amongst pregnant women and young children.

4. LEGAL REQUIRMENTS COVERING THE REMOVAL OF LEAD-BASED PAINT

4.1 Resource Management Act 1991

Under Section 15 of the Resource Management Act, contaminants cannot be discharged into the air, or onto land, unless a resource consent has been obtained from a Regional Council, or unless the discharge is permitted in a Regional Plan. In a similar manner the discharge of contaminants into water or onto land in circumstances that might result in the contaminant entering water is also restricted. For example leaving lead paint debris on land in such a way that it could run-off into a waterway constitutes a breach of the Act.

Regional Councils have tended to issue consents to abrasive blast structures (discharge to air) within a geographical area. Such consents normally conditions which commonly exclude the abrasive blasting of lead painted structures. Abrasive blasting of lead painted structures require a separate consent from most Regional Councils.

4.2 Health and Safety in Employment Act 1991

4.2.1 Requirements of the Act as they Relate to Lead Paint Removal

Employers must protect their employees and other persons in the vicinity from hazards associated with their work. As exposure to lead in paint removal work is a recognised occupational hazard and can cause 'serious harm', an employer must take all practicable steps to eliminate, isolate or minimise the 'significant' hazard.

Employers are required by the Act to monitor the health[1] of their employees and exposure to significant hazards where a 'minimisation' method of hazard management is adopted. They must also notify the Occupational Safety and Health Service of the Department of Labour where occupationally induced lead poisoning is identified for any of their employees.

The Act also requires a Principal (who appoints a contractor) to ensure that the Contractor is not harmed by hazards associated with the contracted work. As a competent contractor should be well aware of the hazard of lead-based paint, the duty of the Principal is largely to ensure they select contractors who are aware of the hazard, and capable of managing it effectively.

Lead poisoning is also a notifiable occupational disease, whereby occupational health professionals may notify the Occupational Safety and Health service where occupationally induced lead poisoning is identified or suspected (the NOD's System).

[1] Described in full in *Guidelines for the Medical Surveillance of Lead Workers*, OSH, Department of Labour, 1994.

4.2.2 Requirements of the OSH Code for the Management of Substances Hazardous to Health

Under this code employers are required to demonstrate they have assessed the risks both from hazardous substances used in their work or when toxic substances are generated in their course of their work. This extends to toxic welding fumes and dust contaminated with toxic materials in abrasive blasting, and in some cases the abrasive used for blasting where it is hazardous to health.[2] Contractors undertaking abrasive blasting projects therefore have to be able to produce a written assessment of the potential health effects on their employees and the necessary steps that must be taken to minimise that hazard.

4.3 Health Act 1956

The Health Act 1956 is the prime statute controlling health hazards to the public at large. It identifies lead poisoning from non-occupational sources as a notifiable disease (Schedule 2), which must be reported by a medical practitioner to the Medical Officer of Health. The Medical Officer of Health may inform occupants of the premises concerned of the precautions to be taken, and can require Environmental Health Officers and Health Protection Officers to take action as necessary.

Under the Health Act, Environmental Health Officers may issue Cleansing Orders (S.41) or Closing Orders (S.42) to deal with lead contaminated properties, or use nuisance provisions under the Act to require work to be done to abate a statutory nuisance.

4.4 Other Health and Safety Legislation

Contractors undertaking work on bridges must comply with the requirements of the Health and Safety in Employment Regulations 1995, particularly the requirement to take steps to minimise the likelihood of falls of 5m or more.
Under these regulations certain types of activities must be notified to OSH at least 24 hours before work commences. The most relevant notifiable activities include:

- Construction work where there is a risk of a fall of 5 metres.
- The erection or dismantling of scaffolding from which a person could fall 5 metres or more.

In addition, specific Approved Codes of Practice issued by the Minister of Labour should also be complied with by the contractor. For example codes exist on scaffolding and the use of cranes and lifting appliances. These are issued on a regular basis.

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[2] OSH have issued a policy (1996) restricting the content of silica in sand used for abrasive blasting to less than 5%.

5. MAINTENANCE OF ROADING STRUCTURES CONTAINING LEAD-BASED PAINTS

5.1 Pre-Contract Identification

Prior to the letting of any tender to undertake maintenance work on roading structures, the presence of lead paint must be determined. When it is not known whether a roading structure contains lead paint then a test for lead content must be carried out. Acceptable field tests for undertaking a determination of lead paint on painted steelwork are:

(1) Use of a 5% sodium sulphide solution
(2) Use of the rhodizonate swab kits (surface samples only).

The sodium sulphide test will turn paint flakes black where the paint has a lead content exceeding 5%. Concentrations from 1-5% will change the colour to various intensities of grey. This may be indistinct and laboratory confirmation may be required. The rhodizonate test involves a colour change to pink or red which will occur if the lead content exceeds 0.5%.

Test kits are available from commercial scientific supply organisations, and may also be available from hospital laboratories or Public Health Units. Samples of paint flakes may also be submitted to a laboratory for testing. A full description of the test methods may be found in Appendix A of AS 4361.1 or the OSH Guidelines on the Management of Lead-Based Paint.

5.2 Determination of Painting Strategy

Where the presence of lead paint is determined in concentrations exceeding 1% (w/w) then 4 basic painting strategies should be considered. These include:

(1) Defer painting.
(2) Overcoating or encapsulation.
(3) Spot or localised repair.
(4) Total coating removal and replacement.

In determining the most appropriate painting strategy the following factors should be considered:

- Assessment of the condition of the existing coating.
- Remaining service life of the structure.
- Proximity of work to environmentally sensitive areas.
- The need to avoid disruption of traffic flow.
- Benefits obtained from the different surface preparation techniques weighed against public health and environmental risks.
- Concerns over appearance.
- Costs.

Where total replacement or removal, or spot or localised repair is decided on, then an assessment of both public and environmental risks should be undertaken.

5.3 Risks to Public, Workers and Environment

As it may not be possible to completely control emissions of lead-containing material during maintenance work, the risks arising from the potential hazard need to be assessed and adequately managed in order to avoid adverse effects on worker or public health, or the environment. The results of the risk assessment will be dependent on the location and nature of the project, and will determine the level of emission control required for the maintenance work.

In any individual situation, hazards arising from lead paint removal may be presented to any of the following receptors:

- Workers conducting paint removal operations,
- Unrelated workers in the vicinity of the removal operations,
- The public using or adjacent to the structure,
- Distant populations, residential or industrial, due to air dispersion,
- Grazing stock,
- Aquatic species, or
- Other animals and plants in the vicinity of the removal operations.

The pathways that lead and other toxic metals can take to reach the above receptors may include air, water, soils, or waste streams.

This section[3] describes how the following risks may be assessed:

- Risk to adjacent workers, based on their proximity to the work area and frequency of their presence;
- Public health risk, based on the proximity of the public to the work site and the frequency of their presence;
- Environmental risk based on the proximity of unprotected ground surfaces and water bodies (including stormwater systems) to the project site.

5.3.1 Assessment of Adjacent Worker Health Risks

This method applies to workers or facility personnel in the vicinity of a lead paint removal project who may be unintentionally exposed to lead during their normal work activities. Their risk is based upon their proximity to the project and the frequency with which they are at that location.

The overall risk to adjacent workers is established as nil, low or high, by combining the proximity and frequency indicators as shown in Table 1.

[3] The procedures described are based on those contained in Project Design: Industrial Lead Paint Removal Handbook, Vol.II (SSPC 94-18, K. A. Trimber and D. P. Adley) and in Appendix C of AS 4361.1.

Table 1: Health Risk to Adjacent Workers and Other Workers on Site

Proximity to site	**Frequency of presence of personnel in the project area**		
	Rare (no scheduled presence)	**Occasional (<2hrs/shift)**	**Continual (>2hrs/shift)**
Close (<15m)	Low	Low	High
Moderate (15-100m)	Nil	Low	Low
Far (>100m)	Nil	Nil	Nil

5.3.2 Public Health Risk Assessment

This method applies to the public at large and includes residents of nearby communities and businesses, "passers-by" and potentially affected distant populations. The overall risk to the public health is established by combining the variables of proximity of the public to the removal project and the frequency with which the public is present in the proximity of the project site.

5.3.2.1 Proximity indicators

Public areas sufficiently close to a project to be within the likely deposition zone from air dispersion of dust containing lead or other toxic metals are an obvious concern. Indirect discharges to soils in areas of public use near the project pose a similar risk.

In assessing the public health risk based on the proximity of the public to the project site, the nearest location (in any direction) of the public is determined and quantified in terms of direct measurement and in terms of the height of the structure on which the paint removal operations are being performed. The most restrictive distance assessment is used. As a simplifying assumption, the proximity component of the public health risk assessment is made independent of any other variable, such as the method of removal, or predominant wind direction or velocity.

The proximity indicators are classified as: no access, far, moderate and close (see Table 2).

5.3.2.2 Frequency indicators

The second variable in assessing overall public health risk deals with the frequency with which the public may be present in the proximity zone. The frequency indicators are classified as: never, rarely, occasional and continual, as described in Table 2.

The overall risk to the public is established as nil, low, moderate or high by combining the proximity and frequency indicators as shown in Table 2.

Table 2: Public Health Risk Assessment

Public Proximity to Site	**Frequency of Public Presence**			
	Never (no access)	**Rare (restricted or transient access)**	**Occasional (likely on periodic basis)**	**Continual (relatively full-time)**
Close (<30m or 2 x height of structure)	Nil	Moderate	High	High
Moderate (30-300m or up to 5 x height of structure)	Nil	Low	Moderate	High
Far (>300m or 5 x height of structure)	Nil	Low	Low	Moderate
No Access (and >750m)	Nil	Nil	Nil	Nil

5.3.3 Environmental Risk Assessment

This method addresses risks to the environment based upon the proximity of unprotected ground surfaces or water. These risks may arise from discharges of lead-containing materials directly to the ground or water, or indirectly via air dispersion and deposition.

The environmental impact is determined by assessing the distance of the soil or water body from the project site. As a simplifying assumption, the assessment of potential environmental impact is based solely on a distance and is completed by making a determination of whether the closest (sensitive) soil or water area to the project site is either distant or near, with the risk correspondingly assigned as low or high (see Table 3).

Removal of lead-containing paint from a bridge above a pristine waterway could result in adverse environmental impacts both from deposition into the water body, and via runoff from the surrounding soil areas. Depending on the presence of sensitive receptors or direct ingestion pathways immediately downstream, a discharge onto soils may pose more or less of a direct environmental impact than discharges of materials into freshwater stream. In soils, the lead is likely to have a longer residence time and may be more available for animal or public exposures than when it falls into the river.
Discharges to the waterbody, however, might affect aquatic life or be carried to the shore where the public or farm animals might be exposed. It may also affect drinking water quality if the water body is the source of a potable supply.

Environmental impact to water from soil discharges could also occur, either through stormwater run-off carrying the contaminated materials to a surface water or through the more protracted process of groundwater contamination. Assessment of overall

environmental impact, therefore, should consider the proximity of the project site to either soil or water.

A resource consent is required from a Regional Council for any discharge into water, or onto or into land in circumstances where the contaminant may enter water, unless a rule in a regional plan permits the activity. Discharges into air, or onto land, from an industrial or trade premises, also require a consent, unless a rule permits otherwise.

Table 3: Environmental Risk Assessment

Proximity of Unprotected Ground Surface to Site Boundary	**Proximity to Water**	
	Distant (>60m or 5 x height)	**Near (<60m or 5 x height)**
Near (<60m or 5 x height of structure)	High	High
Distant (>60m or 5 x height of structure)	Low	High

5.3.4 Interpretation of Results

In all cases, the project manager should develop a scale plan of the project site and surrounding area. The plan should identify the type of environmental media and all surface developments (buildings, playgrounds, structures, etc) within 500 metres of the work site. Risk assessment documentation for the project should include the following:

- Site plan.
- Identification/observations of exposed populations.
- Distances of potentially affected receiving environments from the project site.
- Risk to adjacent workers, identified as nil, low or high.
- Public health risk, identified as nil, low, moderate or high.
- Environmental impact, identified as low or high.
- Name, signature and function of the risk assessor.
- Date of assessment.

5.3.5 Control Level for Emissions

The three indicators determined above for adjacent worker, public health and environmental risks can be used to establish site-specific limitations on emission levels. This determination should provide the foundation upon which the waste containment and removal system will be selected and also the project monitoring requirements.

The three risk indicators are combined in the matrix shown in Table 4. The environmental risk impact is plotted in the matrix first. This confines the remaining selections to the left half (low environmental impact) or right half (high environmental

impact) of the matrix. The column which represents the risk to adjacent workers is then selected followed by the indicator of public health risk. The intersection of the three indicators represents the recommended project-specific emission control level, defined as follows:

- Emission control level A - a high level of control where minimal emissions are allowed;
- Emission control level B - a moderate level of control where limited emissions are allowed; or
- Emission control level C - the lowest level of control where limited emissions are allowed.

Level C would be applicable where, by virtue of the remoteness of the location and the small scale of the work, risks to the environment and to the public from lead paint emissions are low.

Table 4: Project Specific Emission Control Level

		Risk to Adjacent Workers					
Public Health Risk		**Nil**	**Low**	**High**	**Nil**	**Low**	**High**
	High	A	A	A	A	A	A
	Mod	B	B	A	A	A	A
	Low	C	C	A	B	B	A
	Nil	C	C	A	B	B	A
		Low			**High**		
		Environmental Impact					

5.4 Appropriate Methods of Removal and Containment

This section discusses the combinations of paint removal methods and containment systems that are capable of achieving the required level of emission control for a project. Paint removal methods used will fall into one of four categories in terms of the level of emissions generated by each, as shown in Table 5.

Table 5: Emissions Associated with Different Removal Methods

Emissions Category	Removal Methods
1. Very High	Open abrasive blasting with expendable or recyclable abrasive.
2. High	Water blasting, wet abrasive blasting and sodium bicarbonate blast cleaning.
3. Moderate	Sponge jetting, blasting with a cryogenic medium, chemical stripping, vacuum blasting and power tool cleaning without vacuum attachments.
4. Low	Centrifugal wheel blast cleaning, power tool cleaning with vacuum attachments and hand tool cleaning.

The paint removal method must take into account the risk level (A, B or C) determined in section 5.3. However other factors will also come into consideration such as the degree of surface preparation needed, size and configuration of the structure.

The necessary degree of containment required must take into account:

- The calculated risk to adjacent workers, the public and the environment (A, B or C); and
- The emissions category as shown in Table 5.

Appropriate containment design criteria are given in Table 6. Emission control level A provides the greatest control over emissions, Level B provides a lower level of control while Level C provides the lowest level of control.

5.5 Management of Waste

5.5.1 Solid Waste

Paint debris and contaminated abrasives from lead-based paint removal projects must be treated as hazardous waste.

All potentially hazardous debris from the containment or work area must be collected daily in a way that minimises spread of dust, preferably by pneumatic channelling or vacuuming. Shovelling or sweeping must be minimised.

Hazardous waste collected must be placed in sealed drums, bins or other containers labelled as hazardous waste. Storage areas for hazardous waste for the duration of the project should be sited away from areas of potential flooding. Warning signs should be posted in the area where hazardous waste is being stored.

Hazardous waste should be disposed of at a landfill that is permitted to accept such waste. Agreement should be sought in advance from the appropriate local authority.

Table 6: Containment Methods for Various Paint Removal Methods

Emission Category	Emission Control level	Containment Material	Containment Joints	Containment entryway	Ventilation System	Negative pressure	Exhaust Filtration
Very High (dry abrasive blasting - recyclable or disposable abrasives)	A	Impermeable (1)	Fully sealed	Airlock or resealable	Mechanical	Required	Required
	B	Permeable or Impermeable (1)	Partially sealed	Overlapping	Natural	Not Required	Not Required
	C	Note 2	N/A	N/A	Natural	Not Required	Not Required
High (wet abrasive blasting water jetting methods with or without abrasive injection)	A	Impermeable (1)	Fully sealed	Resealable or Overlapping	Mechanical	Required	Required
	B	Permeable or Impermeable (1)	Partially sealed	Overlapping	Natural	Not Required	Not Required
	C	Note 2	N/A	N/A	Natural	Not Required	Not Required
Moderate (Power tool cleaning without vacuum attachments - vacuum blasting, cryogenic blasting, chemical stripping)	A	Impermeable (1)	Fully sealed	Resealable or Overlapping	Mechanical	Required	Required
	B	Permeable or Impermeable (1)	Partially sealed	Overlapping or open seam	Natural	Not Required	Not Required
	C	Note 2	N/A	N/A	Natural	Not Required	Not Required
Low (vacuum shrouded power tools, centrifugal wheel cleaning and hand tool cleaning).	A	N/A	N/A	N/A	Natural	Not Required	Not Required
	B	N/A	N/A	N/A	Natural	Not Required	Not Required
	C	Note 2	N/A	N/A	Natural	Not Required	Not Required

Note 1: Permeability to air and water. In all cases, ground covers should be water impermeable and of sufficient strength to facilitate the collection of water and debris for proper testing and disposal. For further information and a recommended specification for containment refer to Appendix 6 of the Transfund New Zealand 'Model Specification'.

Note 2: Impermeable ground covers and free hanging tarpaulins to control accidental releases or spills are sufficient for Level C controls.

Note 3: This table is based on Tables D1 & E1 of AS4361.1.

5.5.2 Liquid Waste

When paint is removed by water blasting, waste water must be discharged via a filter or earth dam before passing into the stormwater drain or ground soakage. This will filter out the paint fragments, which must be disposed of as a contaminated waste as above.

For larger jobs, settlement and filtration of the wastewater arising may be necessary prior to its disposal to the stormwater drain.

The disposal of wastewater to the stormwater drain is only acceptable if there is no resultant adverse effects in the receiving environment, or it is not practicable to divert this wastewater to the foul sewer. In either case, lead in the wastewater is likely to enter the wider environment, and so the emphasis should be on removal at source, and proper disposal of the concentrated contaminated waste.

5.6 Worker Protection

Contractors who undertake a lead paint removal project must provide a project safety plan to the principal or principal's agent. This will provide information on how they intend to comply with the requirements of the Health and Safety in Employment Act 1992.

The project safety plan must specify:

- What washing (showers, handbasins) facilities are to be provided at the site.
- What protective equipment and clothing will be issued to workers. The most recent dates training has been provided on the hazards of lead, the importance of personal hygiene, correct use of respirators and measures to minimise lead dust emissions and worker exposure to lead during coating removal projects of this nature.
- How the contractor will minimise risks to employees and bystanders from lead dust emissions particularly if abrasive blasting is used. The contractor should describe the method of containment including how often visual checks will be carried out of the containment structure's integrity (where full containment is necessary) and ventilation systems (where they are deemed necessary).
- How other health and safety hazards will be dealt with. For example a traffic safety management plan may be required if work impinges on the flow of vehicles across a structure.
- The nominated contact person at the site responsible for ensuring this plan is named.
- Acknowledgment that blood lead tests have been offered to employees or confirmation from an OSH Medical Practitioner or Occupational Physician that blood lead tests are not required for a contract of this nature.
- Appendix 1 is a checklist for contractors of important health, safety and environmental matters to be considered at the planning stage. Appendix 2

describes matters that should be addressed in a Project Health and Safety Plan.

5.7 Contractor Site Clean Up and Clearance

Even if paint removal methods minimise emissions of lead dust and debris to the environment during the course of the project, care must be taken to ensure contamination of soil and water does not occur during dismantling of containment structures and removal of equipment from the site.

At the end of the project the structure confined within containment should be cleaned of visible dust using compressed air hoses.

Then prior to removal of containment facilities around the structure being worked on, the containment cocoon (if required as part of the contract) and the equipment and structures within (e.g. scaffolding) should be cleaned using vacuum cleaners with HEPA filters and visually inspected to check for residual dust.

The Contractor will also be required to clean down all equipment used such as blast hoses and ductwork used in ventilation systems.

Thorough visual inspections are necessary at each stage of the cleanup (particularly prior to dismantling of containment structures) to ensure site contamination does not occur.

5.8 Coating Systems

The specification of proprietary paint systems can be obtained from a reputable coating manufacturer, or a generic specification may be commissioned from a consultant. This should be preceded by an assessment of the existing coating condition (including adhesion tests) in accordance with Appendix B of AS 4361.1. Where overcoating or encapsulation is proposed, a trial application of the proposed system or systems is recommended to check on compatibility, and whether curing and weathering of the new system causes delamination during operation of the structure.

The selection of the most suitable and cost effective coating system depends on various factors including:

- The degree of pitting on steel structures.
- The proximity of the structure to the coast and windborne salts.
- Whether encapsulation, a spot repair, or total replacement is required.
- The generic type and adhesion of the existing coating to be overcoated.
- The required time until next maintenance or cost to provide access for painting.
- Aesthetic requirements (e.g. colour, gloss levels, graffiti resistance).
- The prevailing weather conditions (e.g. temperature and humidity).

- The time available for repainting (e.g. rapid cure system may be necessary).
- The presence of crevices (e.g. from riveted or bolted joints).
- The degree of surface preparation(e.g. if abrasive blasting is not used).

Systems that may be suitable are suggested in the Transfund New Zealand Model Specification 1998.

6. ENVIRONMENTAL STANDARDS

6.1 Lead in Air (Occupational Exposures)

The concentration of lead that a typical employee may be exposed to without suffering adverse health effects is called a Workplace Exposure Standard (WES). This can be expressed in terms of average exposure throughout a working life, in which case it is called a Time Weighted Average (WES-TWA). The WES-TWA is thus the permitted concentration in air for an exposure of 8 hours per day, 5 days per week.

In practical terms, where it is likely that the WES-TWA would be approached, the employee must be protected. For paint removal operations this is typically by the use of dust suppression or collection systems, and where necessary, filter respirators or supplied-air systems.

Although the WES-TWA states a maximum unprotected exposure level, it would be expected that exposure management action be considered where levels exceed half the WES-TWA. Both the WES and action levels are shown in Table 7.

6.2 Lead in Air (Exposure by General Public)

Table 7: Occupational Exposure Standards

Criteria	Concentration in Air
Maximum level (WES-TWA)	0.1 mg/m3
Suggested Action Level	0.05 mg/m3

Ambient air quality guidelines published by the NZ Ministry for the Environment give a maximum of 0.001 mg/m3 as a three month moving average calculated monthly. This is based on a the same level as an annual mean given in the WHO Guideline for Europe which incorporates a safety factor of two and assumes that 98% of the population will maintain a blood lead level below 0.2 µg/ml (20 µg /dl).

6.3 Lead in Soil

The group most likely to be exposed to lead in soil are children between the ages of 1 to 5 years, who at a conservative estimate may ingest up to 100mg/day of soil. Thus a stricter standard is required for soil in which children may play, than for other soils.

Investigation levels are those at or above which a risk assessment and contaminant source investigation should be initiated. Action levels are those at or above which there is potential for harm, and remedial action is necessary. Background, investigation and action levels are shown in Table 8.

Table 8: Acceptable and Action Levels for Lead in Soil

Criteria	Lead Level
Background Level (Bare soil)	<200 mg/kg (ppm)
Investigation Level (Bare soil)	300 mg/kg (ppm)
Action Level (Bare Soil)	1000 mg/kg (ppm)
Action Level (Childrens play area)	300 mg/kg (ppm)

Source: Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines (acceptable and investigation levels).National Centre for Lead safe Housing (USA) 1994, Guidelines for Action Levels.

7. PERSONAL HEALTH STANDARDS

7.1 Blood Lead Content

Blood lead content is accepted as a measure of recent lead exposure, and can be easily measured by taking a blood sample. The blood lead level which is deemed to be satisfactory or unsatisfactory varies with whether the person concerned receives their exposure as an employee (contractor) or as a member of the general public. Current New Zealand standards are summarised in Tables 9 & 10.

7.2 Standards for Occupational Exposure

The issue of occupational blood lead level surveillance is addressed in detail in the OSH publication Guidelines for the Medical Surveillance of Lead Workers. A summary of blood lead thresholds is presented in Table 9.

Table 9: Blood Lead Levels - Occupational Standards

Action Criteria	Whole Blood Lead Level
Maximum Acceptable Level	1.5 µmol/litre
Notification Level	>2.6 µmol/litre
Suspension Level	>3.2 µmol/litre for a single test or >2.6 µmol/litre for 3 consecutive tests

The frequency of blood testing for existing employees is dependent on their exposure characteristics, and should be determined by an Occupational Health Nurse or other suitably qualified medical professional.

Irrespective of the test frequency, where employees experience the symptoms of acute lead poisoning, they should approach their medical practitioner to arrange a test.

7.3 Public Health Standards

The standards currently stated in the second schedule of the Health Act 1956 (as amended by the Infectious and Notifiable Diseases Order 1996) are given in Table 10.

Table 10: Blood Lead Levels (General Public)

Criteria	Blood Lead Levels (General Public)
Notifiable level (All age groups)	> 0.072μmol/litre (whole blood) or 15 μg /dl

8. MONITORING PAINT REMOVAL PROJECTS

8.1 Introduction

This section covers the monitoring that may be required before, during and after a lead paint removal project. Monitoring may be necessary to ensure that adequate controls are in place to protect the environment, the public or neighbouring workers, and other facility personnel, and to ensure that conditions set in the resource consent for the project have been met. The nature, extent and frequency of monitoring required for any specific project will be determined by the potential health and environmental risks identified and the emissions potential of the paint removal method selected. Thus monitoring requirements will be related to the emission control level established for the project, as discussed in section 5.3.5.

Regulatory requirements for monitoring are noted below followed by a summary of the monitoring methods recommended, along with the various guidelines that should be used in evaluating the results. Details of monitoring methods can be found in Appendices F, G and H of AS 4361.1.

8.2 Regulatory Requirements

Lead paint removal may involve discharges to air, water or land, and all of these are controlled under the Resource Management Act. The exact nature of any controls will depend on the requirements of the Regional and/or District Plans relevant to the specific project area. The two most likely approaches are as follows:

- The activity will be permitted, with a general requirement to avoid any adverse effects such as soil and water contamination or the generation of any nuisance effects due to dust; or

- The activity will be discretionary and it will be necessary to apply to the council for a discharge consent. This may involve providing evidence to show how any effects of the activity will be minimised, and monitoring may be required as a condition of the consent to prove that this is the case.

Lead paint removal is also covered by the Health & Safety in Employment Act, which requires that companies take all practicable steps to ensure the safety of their employees and other people that may be at risk from those work activities. This can include monitoring employee health, and their exposure to hazards such as dust and lead.

8.3 Monitoring Types

Three types of monitoring may be required, as follows:

- Air quality monitoring, for determining the adequacy of any emission controls, the extent of any off-site effects, and the level of protection required for other workers on site.

- Ground (soil) monitoring, to determine the level of contamination resulting from the paint removal operation (if any), and the need for site remediation.

- Water and sediment monitoring, to determine the levels of contamination resulting from the paint removal operation (if any), and the need for remediation.

The extent to which any of this monitoring is required will depend on the size and location of the paint removal operation, and the potential risks presented.

8.4 Monitoring Methods

8.4.1 Air Quality

Three methods which may be used for air monitoring are as follows:

- Suspended particulate monitoring. Air is drawn through a pre-weighed filter using a high-volume sampling apparatus. Total dust emissions are determined from any weight gain on the filter and lead emissions are determined by chemical analysis of a portion of the filter. This method is mainly used where there are concerns about possible health or nuisance impacts on the surrounding neighbourhood.

- Establishing regulated areas. This method also involves sampling through a filter, but the equipment used is a low-volume sampler of the kind typically used for monitoring workplace exposures. The measurements are used to determine the extent of any re.g.ulated areas or zones around the activity, to ensure that unprotected workers and other facility or site personnel are not inadvertently exposed to lead or nuisance dust.

- Visual emissions assessment. As the title suggests, this involves visual assessment of emissions from the activity, in a systematic manner, to establish whether the emissions controls are adequate or whether any specific work practices need to be changed. Although this method does not

give quantitative results, it does provide immediate indications of the suitability of the emission controls in place.

8.4.2 Ground (Soil) Sampling

Ground sampling is normally only carried out prior to the start of an operation, and again at the end. This is intended to show whether any significant contamination has occurred, and what level of clean up might be required. It therefore provides a determination of the adequacy of the project emission controls.

The recommended procedure involves collection of plugs of soil using a soil sampling tool, and laboratory analysis for lead. This generally involves sampling in a fixed grid pattern within the immediate vicinity of the operation, and at some distance away from it, and additional samples from any nearby "high risk" areas, such as schools and housing.

Visual examination for any surface contamination due to paint chips or other debris, during the course of the project, is also recommended.

8.4.3 Water and Sediment Sampling

Sampling of surface waters and sediments is only recommended for slow moving, shallow bodies of water, or where drinking water intakes or sensitive environmental receptors (e.g. shellfish beds), are near the site. Samples should be taken both before and after the paint removal operation, to determine the extent of any change in contamination levels.

Water samples are collected by grab or dip sampling, directly into sample bottles. Sediment samples are collected with a sampling scoop from the top 100 mm layer. All samples are submitted for laboratory analysis.

Visual examination for any contamination due to paint dust or other debris, during paint removal, is also recommended.

Guidance on the number, location and frequency of samples for air, soil and water monitoring, for different types of structures and locations, is given in AS 4361.1. This includes methods for the determination of initial "background" levels.

8.5 Background Data

It is important for background samples to be included in any of the above monitoring exercises, because of the historically wide distribution of lead throughout the environment. This will normally be achieved by monitoring prior to the start of any paint removal operation.

8.6 Health Monitoring

The health effects of lead should be a primary concern for any paint removal operation, both for the workers involved and for anybody else who potentially may be exposed.

Lead exposure is normally assessed using blood analysis. This may be done routinely in exposed workers, but would normally only be used for the general public for the investigation of suspected lead poisoning. Once again, it is important to establish baseline levels in the exposed group, due to the possible effects from other sources of lead.

8.7 Assessment Criteria

The results from any of the monitoring outlined above need to be compared against appropriate criteria to determine the extent of any adverse effects. The relevant criteria are shown in Table 11.

Table 11: Criteria for Assessment of Monitoring

Parameter	Standard
Air (public exposures)	NZ Ambient Air Quality Guidelines (MfE)
Air (workplace)	Workplace Exposure Standards (OSH)
Soils	ANZECC Guidelines for Contaminated Sites (MfE)
Environmental waters	ANZECC Water Quality Guidelines (MfE)
Drinking water	NZ Drinking Water Standards (MoH)
Health (workplace)	Workplace Exposure Standards (OSH)

Accepted standard levels are listed in Sections 6 and 7. The following criteria can be used to determine whether contamination has occurred at a project site.

8.7.1 Soil Monitoring

An increase of more than 50 ppm or 10% (which ever is the greater) over the initial soil lead level may be considered contamination resulting from the work. Any soil that is above 1000 ppm lead and has been contaminated as a result of the project work, should be removed. This level may need to be reduced to 300 ppm in areas of high public health risk or environmental sensitivity.

8.7.2 Water and Sediment Monitoring

A water body may be considered to be contaminated by the project activities if:

(a) Paint chips or debris are visually evident in the water or sediment.
(b) The lead level of the water increases by 0.5 µg/litre or 10% (whichever is the greater) over the initial level measured.
(c) The lead level of the sediment increases by 50 ppm or 10% (whichever is the greater) over the pre-project measured level.

8.7.3 Air Monitoring

Where visible dust emissions are not permitted under the Resource Consent, the Contractor should continuously monitor visually for any emissions from any contained area, and where evident, should cease operations and effect any modification or repairs necessary to prevent any recurrence.

The results of all visual monitoring should be documented.

8.8 Minimum Level of Monitoring

In all cases the minimum level of monitoring undertaken should be visual monitoring for air emissions and the presence of paint flakes or dust, or other surface preparation debris on the ground, or adjacent water surfaces or in associated sediment.
If at any time during the project, the lead levels increase above what is specified as acceptable, work should cease until the cause of the increase is identified and rectified.

9. REFERENCES

Australian Standard 4361-1995. Guide to Lead Paint Management Part 1: Industrial Applications.
Guidelines for the Management of Lead-Based Paint (1995). OSH, Department of Labour/ Public Health Commission.
Guidelines for the Medical Surveillance of Lead Workers (1994), OSH, Department of Labour.
Workplace Exposure Standards (1994), OSH, Department of Labour.
Australian Water Quality Guidelines for Fresh and Marine Waters (1992), Australian and New Zealand Environment and Conservation Council.
Ambient Air Quality Guidelines (1994), Ministry for the Environment.
Model Specification for the Cleaning and Recoating of Steelwork coated with Lead-Based Paint (1998), Transfund New Zealand.
The Environmental Case Management of Lead Exposed Persons - Guidelines for Public Health Services. NZ Ministry of Health, 1998.

10. ACKNOWLEDGEMENTS

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Lead Paint Removal from Roading Structures
Checklist for Contractors

		YES	N/A
1.	Have you obtained the necessary consents and permits for the work:		
	A Resource consent (if required by Regional Council).	☐	☐
	B Notified OSH if working where falls exceeding 5 metres are possible.	☐	☐
	C Approval from appropriate local authority for disposal of lead waste.	☐	☐
2.	Has the paint on the structural steel been tested for lead content?	☐	☐
3.	If lead is present have the risks to environment and public health been considered (according to the Transfund NZ Guidelines for the Management of Lead-based Paints on Roading Structures) and appropriate measures specified to minimise effects on the environment? (Note: This should have been carried out by the project consultant or road controlling authority and clearly explained in the specification.)	☐	☐
4.	Have you provided adequate numbers of labelled sealable bins, drums or containers for the collection of lead waste?	☐	☐
5.	Have you determined a no-go zone around the work area and erected appropriate signs, so that unprotected people are not exposed to lead containing dust?	☐	☐
6.	If you need to erect an enclosure to contain dust emissions and paint debris have you checked that all joints are adequately sealed (if specified) and that no dust or debris will escape from the enclosure, once work begins?	☐	☐
7.	If required in the specification have you checked the ventilation in the enclosure to see if it is working properly?	☐	☐
8.	If wet abrasive blasting or water blasting is used are all discharges being contained so that lead contaminated run-off is not flowing into watercourses?	☐	☐
9.	Have toxic dust respirators and protective clothing been provided to employees exposed to dust that may be contaminated with lead? Has hearing protection and other protective equipment been provided where necessary?	☐	☐
10.	Has the blood testing of employees been considered and arranged where necessary?	☐	☐
11.	Have you given someone the job of carrying out regular checks to ensure there is no contamination on soil or water from work activities and that all enclosures (if required) are working well?	☐	☐
12.	Have you provided for employees suitable		
	• Washing facilities?	☐	☐
	• Shower facilities?	☐	☐
	• Fresh drinking water, and a	☐	☐
	• Place for meals away from work area?	☐	☐

Checklist Completed By: _____ Date: _____

Project Health and Safety Plan
Checklist for Contractors

Your project Health & Safety Plan should cover the items in the following check list:

		YES	N/A
1.	Washing facilities and amenities that will be provided at the site.	☐	☐
2.	Protective equipment that will be issued to employees.	☐	☐
3.	A description of measures taken to reduce employee exposure to lead dust, including full details of containment systems, ventilation and frequency of site inspections.	☐	☐
4.	Measures taken to minimise any other health and safety hazards. This may cover traffic safety, fall protection etc.	☐	☐
5.	Acknowledgment that blood lead tests have been offered to employees or confirmation from an occupational physician or OSH medical practitioner that blood tests are not required for a contact of this nature.	☐	☐
6.	The contact person at the site responsible for health, safety and environmental protection matters.	☐	☐

Checklist Completed By: _____ Date: _____