

Australian/New Zealand Standard™

Guide to hazardous paint management

Part 1: Lead and other hazardous metallic pigments in industrial applications



AS/NZS 4361.1:2017

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Australasian Corrosion Association
Australian Institute of Building
Australian Paint Manufacturers Federation
Australian Wall and Ceiling Association
CSIRO
Institution of Professional Engineers New Zealand
Master Painters Australia
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Part 1: Lead and other hazardous metallic pigments in industrial applications

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CH-003, Paint and Related Materials, to supersede AS 4361.1—1995, *Guide to lead paint management Part 1: Industrial applications*.

This Standard is Part 1 of the series of two parts providing guidance on the management of paints containing lead and other hazardous metallic pigments. The second part covers lead paint in residential, public and commercial building applications.

As part of the 2017 revision, the scope of this Standard has been widened to include other toxic metallic compounds (e.g. zinc chromate, arsenic and cadmium) that have at times been used in paints, in addition to lead, which was covered exclusively in the previous edition. Although the controls for most of these other toxicants are similar to those used to manage lead in paint, there are specific differences in toxicology and environmental impact that may require modifications to the general procedures of this Standard.

The objective of the Standard is to provide guidelines for the successful management of the disturbance or removal of paints containing hazardous metallic pigments used on industrial steel structures. This document may be referred to in state legislation dealing with the treatment of hazardous paints. However, when preparing for projects that involve the disturbance or removal of hazardous paints, the assistance of suitable experts is necessary.

The term ‘informative’ has been used in this Standard to define the application of the appendix to which it applies. An ‘informative’ appendix is only for information and guidance.

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FOREWORD

Metallic pigments form the basis of most anti-corrosive primers and some decorative paints.

Lead in the form of its various oxides or salts (i.e. inorganic lead) has been used as a key ingredient in industrial paints for more than 100 years due to its excellent ability to protect steel from corrosion and to provide strong, durable colours with excellent resistance to ultraviolet light. Lead primers were found to need minimal surface preparation and consequently were employed for protective treatment of complex steel structures, particularly where difficulties of access and steelwork geometry prevented optimum surface preparation of the steelwork prior to painting. Lead salts in the form of lead sulfochromate pigments have been used in industrial finishes to produce strong yellow, orange and red colours due to the versatility and low cost of these pigments.

The widespread use of lead paints continued until the early 1980s, when concerns about lead-based paint toxicity and the advent of less toxic protective coating systems significantly reduced their usage. Many industrial structures throughout Australia are painted with lead paint systems and, while these systems remain intact, they present no significant health hazard or environmental pollution hazard. However, in most instances these systems will require repair or replacement during the design life of the structure, and the owners will be confronted with potential health and environmental pollution hazards associated with lead paint removal during the course of surface preparation for painting.

Chromium was also widely used in the latter part of the 20th century in the form of zinc chromate (chromium VI or hexavalent chromium), a popular and highly effective anti-corrosive pigment. Zinc chromate primers were used extensively on steel structures and in shipping applications and can be identified through sampling and testing. Chromate has adverse health impacts on the skin and internal membranes and is a known human carcinogen.

Arsenic and cadmium have been used in coloured pigment manufacture mainly in greens and yellows. Each has its own toxicity to humans and presents environmental risks. Although their presence is rare on industrial structures or infrastructure, if suspected, testing should be carried out to identify hazards.

Many structures (e.g. bridges) are located in congested urban areas where hazardous paint removal operations may contaminate nearby residences, business properties or playgrounds. Other structures are located in rural settings where grazing or recreational areas in the vicinity of the structure may be contaminated. Pollution of soil and waterways from hazardous paint removal operations is of concern to environmental protection agencies who require all works to be carried out in accordance with current regulations.

There is a need for sound management of hazardous paint coatings on structures. This Standard addresses the issues critical to management of the selection and implementation of practical, cost-effective maintenance programs that minimize health hazards to workers and the public, and pollution hazards to the environment.

STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard Guide to hazardous paint management

Part 1: Lead and other hazardous metallic pigments in industrial applications

1 SCOPE

This Standard provides guidance on the management of lead-based paints and other hazardous paints (e.g. paints containing zinc chromate and other chromate-based material, arsenic compounds or cadmium compounds). Risk management is also covered as a tool for developing controls for the identified hazards.

This Standard applies to the management of hazardous paints on industrial structures. It includes methods for determining whether hazardous metallic pigments are present on a structure and the selection of a maintenance strategy. Guidance is given on implementing emission controls during paint removal to ensure that potential health risks to workers and the public are reduced to an acceptable level, environmental pollution regulations are observed and a method of handling hazardous waste is selected which meets governing legislation.

For legal obligations associated with managing lead-based and other hazardous paints, refer to work health and safety (WHS) regulatory requirements.

2 APPLICATION

Clause 5 provides information on small paint removal projects, which may not require the full application of this Standard.

Clauses 6 to 21 provide a step-by-step guide that defines the decision path to management of the removal of hazardous paints.

The Appendices A to L provide guidance on a range of topics that enable the application of the decision path approach.

3 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS

1324	Air filters for use in general ventilation and airconditioning (series)
1627	Metal finishing—Preparation and pre-treatment of surfaces
1627.2	Part 2: Power tool cleaning
1627.4	Part 4: Abrasive blast cleaning of steel
2106	Methods for the determination of the flash point of flammable liquids (closed cup)
2106.2	Method 2: Determination of flash point—Pensky-Martens closed cup method
3640	Workplace atmospheres—Method for sampling and gravimetric determination of inhalable dust
3894	Site testing of protective coatings
3894.3	Method 3: Determination of dry film thickness
3894.9	Method 9: Determination of adhesion

- AS
4260 High efficiency particulate air (HEPA) filters—Classification, construction and performance
- AS/NZS
1580 Paints and related materials—Methods of test
1580.481.1.7 Method 1.7: Coatings—Exposed to weathering—Degree of checking
1580.481.1.8 Method 1.8: Coatings—Exposed to weathering—Degree of cracking
1580.481.1.9 Method 1.9: Coatings—Exposed to weathering—Degree of blistering
1580.481.1.10 Method 1.10: Coatings—Exposed to weathering—Degree of flaking and peeling
1580.481.1.11 Method 1.11: Coatings—Exposed to weathering—Degree of chalking
1715 Selection, use and maintenance of respiratory protective devices
1716 Respiratory protective devices
2312 Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
2312.1 Part 1: Paint coatings
3580 Methods for sampling and analysis of ambient air
3580.9.3 Method 9.3: Determination of suspended particulate matter—Total suspended particulate matter (TSP)—High volume sampler gravimetric method
- SSPC (Society for Protective Coatings)
Guide 6 Guide for containing surface preparation debris generated during paint removal operations
- United States Environmental Protection Authority (US EPA)
SW-846 Test Method 1311: Toxicity characteristic leaching procedure (TCLP)

4 DEFINITIONS

For the purpose of this Standard, the following definitions apply.

4.1 Chain-of-custody form

A form that is used to identify the movements of, and to ensure the security and integrity of, a sample.

4.2 Comparable area

The components or portions of a component of an industrial structure which are characterized as having a comparable painting and exposure history, and which are visually similar.

4.3 Competent person

A person who has, through a combination of training, education and experience, acquired knowledge and skills enabling that person to correctly perform a specified task.

4.4 Compliance report

A report compiled by the contractor on completion of a project to confirm or deny compliance with the requirements of all relevant aspects of the project specification.

4.5 Containment system

A system that minimizes or prevents the debris, generated during surface preparation or the removal of hazardous paint, from entering into the environment, and which facilitates the controlled collection of the debris for disposal. It includes the cover panels, screens, wall fabrics, scaffolds, supports and shrouds used to enclose an entire work area or paint removal tools. Containment systems may also employ the use of ground covers or water booms.

4.6 Contractor

The person or corporate body that is party to the contract and bound to execute the work in accordance with the contract.

4.7 Discharge

Accidental or deliberate spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous material or waste into or on any land, water or airspace.

4.8 Disposal

The transfer of hazardous waste to waste receipt or waste treatment facilities in accordance with prevailing regulations, so that no solid waste or hazardous waste, or any constituent thereof, may enter the environment or be emitted into the air or discharged into any waters, including ground waters.

4.9 Hazardous paint

A dry paint containing ingredients that have the potential to create human health risk, toxic workplace atmospheres, hazardous wastes and pollution if disturbed or eroded.

NOTE: Toxic ingredients of paints include lead, chromates, arsenic, cadmium, asbestos, and coal tar derivatives such as phenols or polycyclic aromatic hydrocarbons.

4.10 Hazardous paint compliance plan (HPCP)

A document prepared by the contractor performing the hazardous paint removal giving a detailed description of engineering controls, work practices and safety precautions that will be adopted for the execution of the work.

4.11 Hazardous waste

Wastes that are classified as hazardous by the relevant statutory authority.

Non-liquid waste is usually assessed according to its specific contaminant concentration and the leachability of toxic elements or compounds. Other factors may also be considered during the waste assessment depending on specific requirements in the relevant jurisdiction.

Liquid wastes are usually assessed according to their specific contaminant concentration, pH, odour and dissolved solids.

4.12 HEPA vacuum

A vacuum cleaner fitted with a HEPA filter.

4.13 High efficiency particulate air filter

A high-efficiency particulate air (HEPA) Type 1, Class A filter, as specified in AS 1324, which meets all requirements of AS 4260 with a minimum performance of Grade 2.

4.14 Impermeable

Impervious to dust, water and air.

4.15 Industrial structure

Plant, structures and buildings located exclusively within the workplace of an industrial site and infrastructure, which may include bridges, pylons, pipelines, storage facilities or similar structures.

4.16 Overcoat

A top coat of non-hazardous paint that effectively isolates a surface painted with hazardous paint from the environment.

NOTE: The application of an overcoat is sometimes referred to as 'encapsulation'.

4.17 Owner

The principal holding the title to the asset, or in whom the responsibility for the asset is vested.

4.18 PCBU

Acronym for 'Persons Conducting a Business or Undertaking', as defined in current Work Health and Safety Regulations.

4.19 Registered medical practitioner

A qualified medical practitioner with relevant experience in the provision of health monitoring.

4.20 Regulated area

An area established at the work site to identify areas, outside of which, the air-borne concentrations of hazardous dust can reasonably be expected not to exceed workplace exposure action levels.

4.21 Representative sample

A single or composite sample that can be expected to exhibit the average properties of the waste stream, or contents of a container.

4.22 Responsible person

A person who is capable of identifying hazards (by experience, qualification or training) and has authorization to take measures to minimize the risk.

4.23 Small project

A small-scale short duration project conducted on a single structure which involves the removal of less than 10 m² of hazardous paint.

4.24 Temporary storage

Holding of hazardous waste for a limited period, at the end of which the hazardous waste is treated, disposed of, or stored elsewhere.

4.25 Time-weighted average (TWA)

The average air-borne concentration of a particular substance when calculated over a normal eight-hour working day for a five-day working week.

4.26 Total suspended particulate (TSP)

The total of any particulate matter emitted into ambient air and analysed from samples collected, using high-volume air monitors.

4.27 Toxicity characteristic leaching procedure (TCLP)

A test for determining whether or not debris is hazardous based on an analysis of the leachate.

NOTE: US EPA SW-846, Test Method 1311 provides a method of determining TCLP. This test is employed on the premise that wastes will be consolidated with other rotting wastes which in time will produce organic acids.

4.28 Treatment

Any method, technique, or process that changes the physical, chemical, or biological characteristics or composition of any hazardous waste so as to neutralize such waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store or dispose of, or amenable for recovery, storage or reduction in volume.

4.29 Ventilation system

Includes both natural ventilation and artificial ventilation (mechanical fans, hoods, and ductwork), to provide air movement across the work area. Dust filters are employed to clean the air prior to discharge.

4.30 Waste Generator

Usually the owner or manager of the property on which hazardous waste which is subject to regulation is produced.

4.31 Worker

An individual who works under a contract of employment, apprenticeship or traineeship.

4.32 Workplace exposure (to air-borne contaminants)

The actual level of inhalable dust of a hazardous contaminant in the workplace atmosphere, determined by instrumental air sampling in accordance with AS 3640.

4.33 Workplace exposure action level

An air-borne concentration of a particular substance in the workplace at which specific work health and safety controls should be implemented. The workplace exposure action level is usually set at 60% of the relevant workplace exposure standard.

4.34 Workplace exposure standard

An airborne concentration of a particular substance in the workplace atmosphere, exposure to which, according to current knowledge, should not cause adverse health effects nor cause undue discomfort to nearly all workers, as published by the relevant authority.

5 SMALL PROJECTS

This Standard may not be applicable to some small-scale, short duration projects, as defined in Clause 4.23. Where such a project is not in the immediate proximity of sensitive receptors, (e.g. a child-minding centre or an oyster bed), it need not comply with the provisions of this Standard but would remain subject to all applicable regulatory requirements including, but not limited to work health and safety, environmental protection and waste management regulations.

NOTE: No more than one short duration project, as defined, should be performed on a particular structure within a 12 month period.

6 DECISION PATH

6.1 General

The successful management of an industrial structure coated with hazardous paint requires consideration of the function, design life and service environment of the structure, condition of the existing paint system, maintenance or replacement paint systems which will be effective in the service environment and hazards associated with hazardous paint removal to workers, the public and the environment. These factors and their many intertwined elements need to be judiciously addressed in a logical and systematic manner for satisfactory painting program selection and implementation to take place. Thus, this Standard is presented in the form of a decision path that may be used by an owner of an industrial structure painted with hazardous paint to manage the maintenance of that structure.

In some instances, the amount of hazardous dust, debris or waste produced during a paint removal project may be of such a low magnitude that it may be possible to reduce the level of control, either in monitoring or containment, after assessment of the risk (see Step 3).

6.2 Steps in the decision path

The design phase of a hazardous paint project involves a systematic approach aimed at ensuring that the project achieves its durability aims with no negative impact on workers, adjacent workers, public health or the environment adjoining the site. Each project will require a design phase during which all critical steps are undertaken, in sequence, to cover the unique characteristics of the project site. Guidance with regards to each step in the process is given in Clauses 7 to 21, summarized as follows:

STEP 1: Identifying the presence and measuring the concentration of hazardous metallic pigment in the existing paint.

STEP 2: Determining the total quantity of existing hazardous paint.

STEP 3: Assessing the risks associated with hazardous paint disturbance.

STEP 4: Developing a maintenance painting strategy that addresses the durability requirement while satisfying the risk assessment rating for the project.

STEP 5: Identifying the paint removal/surface preparation methodology and maintenance paint system that will deliver the required durability, whilst satisfying the risk assessment rating for the project.

STEP 6: Designing an access/containment system that safely positions the worker(s) in close proximity to all work zones, which satisfies the emission control requirements and protects workers and the public from harm.

STEP 7: Designing an emissions monitoring system that ensures that emissions will be monitored in accordance with the risk assessment rating for the project.

STEP 8: Determining worker protection strategies that will protect workers from harm.

STEP 9: Developing a waste management plan that addresses all hazardous and non-hazardous solid and liquid waste requirements.

STEP 10: Developing a project clearance plan for returning the site to its pre-project condition, including provision for further investigation and remediation, if required.

STEP 11: Generating a cost estimate to either match the available budget, or to initiate a review of methodology and materials in order to meet budget requirements, or planning for future funding.

STEP 12: Compiling a specification that details all critical materials and processes required to deliver all of the project's objectives.

STEP 13: Developing a hazardous paint compliance plan (HPCP) and submitting to the owner or specifier for approval.

STEP 14: Project implementation which includes site mobilization, the full undertaking of all specified project tasks required under the specification and the HPCP, final demobilization and project clearance.

STEP 15: Preparing and submitting a compliance report for review by the owner, and as a record of the works undertaken.

7 STEP 1: IDENTIFYING HAZARDOUS METALLIC PIGMENT

The first step in any maintenance painting project is to determine whether hazardous metallic pigment is present in the paint at sufficient concentration to constitute a hazardous paint project. This requires either testing on site using portable X-ray fluorescence (XRF, for lead) or on-site sampling with off-site laboratory testing, as covered in detail in Appendix A.

If a hazardous metallic pigment is found to be present, then the risk posed by the project and the potential impact of disturbance on workers, adjacent workers, the public and the environment will be determined on the basis of the total mass of hazardous paint present, as described in Step 2.

8 STEP 2: DETERMINING THE TOTAL MASS OF HAZARDOUS PAINT

The total quantity (mass) of hazardous paint will influence the level of potential emissions and the nature and quantity of waste produced, and therefore needs to be considered prior to undertaking the risk assessment. The greater the quantity of paint, the higher the risk of emissions will be for a given removal strategy.

The volume of paint present on a surface (in litres) can be calculated by multiplying the total surface area (in square metres) by the average film thickness [in micrometres (μm)] and dividing the result by 1000. This will require an estimation of surface area using drawings or measurements on site, and measurement of paint dry film thickness as described in AS 3894.3.

Once the volume of paint is known, an estimate of mass (in kilograms) can be made by multiplying the volume by a factor of 2.

Suggested hazard threshold concentration criteria for determining if a project poses a significant hazard are presented in Table 1.

TABLE 1
THRESHOLD CONCENTRATION
CRITERIA FOR HAZARDOUS
PAINT PROJECTS (% BY WEIGHT)

Hazard	Total mass of paint, kg		
	>250	50–250	<50
Lead	0.1	0.25	1
Zinc chromate (as Cr)	0.05	0.1	0.25
Arsenic	0.05	0.1	0.25
Cadmium	0.05	0.1	0.25

If required, the total mass of hazardous pigment (in kilograms) can then be determined by multiplying the total mass of paint by the percentage concentration of hazardous pigment, and dividing by 100.

If the lead content was determined using XRF [which reports in milligrams per square centimetre (mg/cm²)], total mass of lead (in kilograms) can be determined by multiplying the XRF reading by the total area (in square metres), then dividing by 100.

This information can also be used to estimate the potential concentration of hazardous pigment in the waste produced by the paint removal process.

9 STEP 3: RISK ASSESSMENT

It may not be possible to provide total control over emissions of hazardous dust or paint chips during the maintenance of a structure. The risk assessment process is employed as a means of identifying the level of risk associated with the emissions specific to a paint removal strategy.

The potential impact of hazardous paint emissions on the health of workers, the public and adjacent workers, and contamination of the surrounding environment, will determine the extent of emission controls and environmental monitoring required for a project. The risk assessment procedure is detailed in Appendix B and is based on the following:

- (a) The risk to public health based on the proximity of the public to the worksite and frequency of their presence, designated as high, medium, low or nil.
- (b) The risk to adjacent workers or facility personnel, designated as high, low or nil, based on the proximity to the work area and frequency of their presence. The risk to the workers actually performing the abatement work is as addressed in Step 8.
- (c) The risk to the surrounding environment, designated as high or low, based on the proximity of unprotected ground (e.g. soil or sand) and water (including storm-water drains) to the project site.

For some remote area projects, emission control requirements may be minimal and monitoring may be unnecessary.

The risk indicators from the three individual risk assessments are combined in a matrix to give a project risk assessment rating of A, B or C. The risk rating determines the level of emission control and the extent of environmental monitoring required for the project.

10 STEP 4: MAINTENANCE PAINTING STRATEGY

10.1 Painting strategy alternatives

The following maintenance painting strategies may be considered:

- (a) *No painting* When hazardous paint is in good condition and tightly adhering to the substrate surface and corrosion is minor, there is no immediate hazard and the option of leaving the paint undisturbed and doing nothing may be a viable option. In such cases, consideration needs to be given to the remaining economic life of the structure, and the likelihood of the paint system providing the required service life.

If the hazardous paint has poor film integrity, shows poor adhesion to the substrate or substrate corrosion is an issue, the option of leaving the paint undisturbed, subject to carrying out periodic inspections to monitor paint deterioration, may still be viable.

- (b) *Over-coating* When hazardous paint is adhering tightly to the substrate and showing satisfactory film integrity, the durability can be enhanced by over-coating with another topcoat or paint system. Prior to over-coating, the existing paint should be cleaned to remove dust, dirt, grease, oil, loose paint and other contaminants in order to maximize adhesion. The over-coating material isolates the existing hazardous paint from the environment, thereby minimizing the hazard.

A number of different paint systems may be suitable for this application.

This option should not be considered where the existing paint film integrity or adhesion to the substrate is suspect. Owners and specifiers should be guided by the recommendation of the manufacturer of the proposed over-painting system. The methodology to be employed for surface preparation should be specified.

Care should be taken to ensure worker protection and containment and disposal of dust, wastes and debris are in accordance with prevailing legislation and the requirements of the relevant statutory authorities.

- (c) *Spot or localized repair* Where surface preparation of localized areas is a viable option, priming and application of one or more paint coats to the repaired areas, or to the whole of the structure, may be a cost-effective option. Care should be taken to ensure worker protection and containment and disposal of dust, wastes and debris are in accordance with prevailing legislation and the requirements of the relevant statutory authorities. Paints that are compatible with the existing paint, and which provide the greatest possible longevity in the given environment, should be selected. Risks associated with this method include the potential for future disbonding within the old paint system which remains, or between the new and the old paints. Corrosion may also occur at the fractured feathered edges of the old system. Spot and localized repair also allows intact hazardous paint to remain which may create an unsightly overall appearance unless all surfaces are given a new finish coat.
- (d) *Total paint removal and replacement* Surface preparation of the entire structure to the extent that all existing paints are removed, and a new protective system is applied, may be a cost-effective option depending on the design life of the structure, and will usually outperform over-coating strategies. However, short-term costs are high due to the labour intensiveness of complete paint removal and the increased levels or complexity of worker protection, emission control and waste disposal requirements.
- (e) *Demolition and replacement of the structure* It may be more cost-effective to replace the structure rather than removing and replacing the hazardous paint. Costs associated with the construction of a field containment, the controls over emissions and worker and environmental protection may instead be applied to the creation of a new structure. The risks of environmental, worker or public contamination are reduced and the service life of the new structure is optimized. For example, demolished steel, coated with lead paint, can be smelted and recycled. The lead is thereby safely eliminated from the site and a new long-lasting system can be applied to the new components during fabrication. A disadvantage is the potential disruption to plant processes or the travelling public while the structure is not available for use.

When demolishing structures coated with hazardous paint, hazard management controls are required and may include clearing of margins for oxy-cutting, stabilization of deteriorated hazardous paints and effective work health and safety and environmental control programs.

10.2 Paint condition assessment

The selection of the optimum maintenance strategy requires a thorough assessment of the condition of the existing paint, together with identification of the form and extent of any corrosion present.

The procedures outlined in Appendix C provide a mechanism for determining whether the existing paint on a structure is a viable candidate for touch-up and over-coating, or if it has sufficient integrity to be repaired. Appendix C provides test procedures for uniformly assessing the percentage of corrosion and paint deterioration on the structure, the paint adhesion and thickness and substrate concerns (e.g. rust scale, under-film corrosion and flaking mill scale).

If the visual assessments and physical tests indicate that repair of the paint is viable, test patches of candidate repair materials may be applied and evaluated as outlined in Appendix C, in order to further confirm that repair is a practicable strategy for the specific coating system.

10.3 Other factors

In addition to the condition of the paint, other factors may need to be evaluated when determining a painting strategy. These factors include, but are not limited to, the following:

- (a) Assessment of the remaining service life of the structure (e.g. a clarifier tank that will be upgraded in 5 years will be viewed differently to a transmission tower with an additional 30 year service life).
- (b) Proximity of the work to the public or to environmentally sensitive areas (e.g. the maintenance strategy on a tank in a residential area will differ from a small conveyor in the centre of an industrial plant).
- (c) Proximity of the work to other facility personnel (e.g. work in a heavily-travelled corridor compared with a remote pumping station).
- (d) The effect that maintenance activities may have on other facility processes. Surface preparation methods which generate even trace amounts of dust may be unacceptable in some facilities (e.g. food or beverage processing).
- (e) The need to keep the structure operational during maintenance work (e.g. bridge repair may necessitate keeping all lanes of traffic open).
- (f) Corporate or owner policies regarding the elimination of hazardous paint from structures (e.g. company policy might require that hazardous paint be completely eliminated during any maintenance activity).
- (g) Willingness to accept risks associated with various maintenance painting options. Localized touch-up may result in ongoing maintenance requirements due to lifted edges and localized detachment.
- (h) Concerns over appearance. Spot repair may not provide an acceptable appearance due to the unsightliness of patch repairs.
- (i) Costs. The strategy should be affordable now and in the future. Life cycle costs need to be carefully analysed.

10.4 Reassessment

As additional data is collected through the remaining steps of the decision process, the suitability of the proposed maintenance strategy should be continually reassessed and modified as required.

11 STEP 5: PAINT REMOVAL/SURFACE PREPARATION METHODOLOGY

11.1 Paint removal

The method of paint removal/surface preparation for a project will be based on a number of factors including—

- (a) maintenance painting strategy as established in Step 4;
- (b) the degree of surface preparation needed to deliver the necessary durability outcome for the maintenance painting exercise;
- (c) the project-specific risk assessment rating as determined in Step 3 (A, B or C);
- (d) productivity requirements to deliver the project within time and cost restraints;
- (e) size and configuration of the structure (e.g. cleaning of a large truss bridge with intricate compound construction may be more conducive to abrasive blast cleaning or high pressure water jetting rather than power tool cleaning);
- (f) surface area to be cleaned and painted;
- (g) time or scheduling constraints or considerations; and
- (h) cost versus budget allocation.

11.2 Dust emission potential

Appendix D describes the various paint removal methods and places them into categories based on the level of dust (or mist) emissions typically generated by the process. The level of potential emissions will impact on the design of the containment system.

12 STEP 6: ACCESS/CONTAINMENT SYSTEMS

12.1 Components

The access/containment system is required to safely position the worker(s) in close proximity to all work zones, satisfy the emission control requirements and protect workers, adjacent workers, and the public, from harm. Containment system component parameters include the following:

- (a) Flexibility of the materials used to construct the containment cocoon.
- (b) Permeability of the materials used to construct the containment.
- (c) The type of support structure required.
- (d) The management of joints between containment materials, and between the materials and the structure being prepared.
- (e) Control of the entryway into the containment.
- (f) The need for mechanical ventilation.
- (g) The need for negative pressure within containment.
- (h) The need for filtration of the exhaust air.
- (i) Monitoring visible emissions during commissioning and subsequent operation.

It should be recognized that although the emission control requirements for a Level A project risk assessment rating can be achieved with any of the removal methods, the feasibility of achieving such stringent controls decreases as the dust-producing nature of the removal method increases (e.g. it will be more difficult to achieve emissions control consistent with a Level A project risk assessment rating during abrasive blast cleaning compared with vacuum-shrouded power tool cleaning).

12.2 Reassessment of strategy

After consideration of the above, if the method of removal and the resulting containment requirements for the project are not feasible, the painting strategy selected in Step 4 should be reconsidered. (Refer also to Step 11.)

13 STEP 7: EMISSIONS MONITORING

13.1 General

An emissions monitoring system should be designed and implemented such that emissions will be controlled and quantified in accordance with the requirements established during the project risk assessment process. The data obtained from such monitoring will be required as evidence that either the project has had no negative impact or, where contamination has occurred, to identify any areas requiring remediation or further investigation. Appendices F to H provide guidance on the design and implementation of the emissions monitoring plan.

Monitoring may include the following:

- (a) *Monitoring for air-borne emission* Appendix F describes monitoring for total suspended particulate (TSP), including monitoring surface dust loadings on nearby non-absorbent surfaces and wet mist fall-out from work sites where wet methods for paint removal/surface preparation are employed.
- (b) *Ground monitoring* Appendix G provides a procedure for the sampling and analysis of the soil and shoreline deposits prior to project start-up and upon completion of work, to determine if the ground has been contaminated as a result of project activities.
- (c) *Water and sediment monitoring* Appendix H provides a procedure for the sampling and analysis of water and underwater sediment prior to project start-up and upon completion to determine if the water or underwater sediment has been contaminated as a result of project activities. Additional sampling and testing may be required when near drinking water intakes.

13.2 Criteria for monitoring

The project-specific methods of monitoring, as well as the frequency and duration of monitoring, are dependent upon the project risk assessment from Step 3.

13.3 Monitoring requirements

Table 2 depicts typical monitoring requirements based on the project risk assessment from Step 3.

TABLE 2
EXAMPLE OF PROJECT
MONITORING REQUIREMENTS

Project risk assessment (see Appendix B)	Monitoring requirements	
A	Air-borne	Continuous
	Visual	Level 1
	Soils	Lab and visual
	Water/Sed.	Lab and visual
	Reg. area	Start and 3-monthly
B	Air-borne	Continuous
	Visual	Level 1
	Soils	Lab and visual
	Water/Sed.	Lab and visual
	Reg. area	Start
C	Air-borne	Not required
	Visual	Level 2
	Soils	Lab and visual
	Water/Sed.	Lab and visual
	Reg. area	Start

LEGEND:

Air-borne

Continuous = full-time monitoring

Visual air monitoring

Level 1 = <1% of work day

Level 2 = <5% of work day

Soils

Lab = laboratory testing of all samples

Visual = visual assessment for debris

Water/sediment

Lab = laboratory testing of all samples

Visual = visual assessment for debris

Regulated area

Start = start-up monitoring only

3-monthly = repeat at three-monthly intervals

13.4 Review of monitoring requirements

Some reduction in the level of monitoring, or the elimination of monitoring altogether, may be considered where test results during the early stages of a project have proven that the systems and controls are effective in protecting the environment, public and other facility personnel.

14 STEP 8: WORKER PROTECTION REQUIREMENTS

All personnel who may be exposed to hazardous paint on the project require protection to avoid personal injury or harm, as well as to prevent hazardous dust or debris from being carried off the work site to potentially affect others.

All health monitoring is subject to the requirements of the authority with jurisdiction over the state, territory or country within which the work is undertaken, and any current legislative requirements.

Worker protection requirements that may satisfy these objectives are outlined in Appendix I, and may include the following:

- (a) Project surveillance by a responsible person (see Clause 4.22 and Paragraph I7).
- (b) Setting the appropriate workplace exposure action level for hazards present, at which the worker safety controls will be implemented.
- (c) Assessment of worker exposure to air-borne hazardous substances, including specific protective measures required while the exposure assessment is being conducted.
- (d) A site-specific written HPCP which addresses methods used to reduce worker exposures to hazardous substances (e.g. engineering and work practice controls).
- (e) The supply and training in the use of respiratory protection.
- (f) The supply and training in the use of protective clothing and equipment.
- (g) Housekeeping programs.
- (h) The supply and use of hygiene facilities.
- (i) The use of medical surveillance before starting and while working on the project.
- (j) A medical removal protection program for workers who present with signs or symptoms of excessive exposure to hazardous substances during the course of the project.
- (k) Worker information and training programs.
- (l) Establishment of regulated areas with signs at all entrances.
- (m) Provisions for maintaining records of all assessments and evaluations.

15 STEP 9: WASTE MANAGEMENT

All debris, whether hazardous or not, should be properly collected, handled and disposed of in accordance with statutory requirements. Each of the paint removal methods will generate a waste, with subtle differences in management requirements (e.g. managing a chemical stripper waste will be different to contaminated water or dry spent abrasive).

An overview of the management of the various waste streams that might be generated during a project is provided in Appendix J, and covers the following:

- (a) Project planning.
- (b) Responsibilities of facility owners and contractors.
- (c) Job site handling and storage of debris.
- (d) Worker training.
- (e) Contingency plans for responding to a spill.
- (f) Waste sampling, classification and analysis.
- (g) Hazardous waste transportation and disposal.
- (h) Transportation and disposal of non-hazardous waste.
- (i) Management of waste water.

16 STEP 10: PROJECT CLEARANCE

A project clearance plan should be prepared to detail the steps that will be taken to return the site to its pre-project condition by cleaning, remediation and other measures as necessary. This should include the removal from site of all access and containment equipment and materials, plant, other equipment, temporary buildings, fencing and vehicles.

Once the project is completed, it will be necessary to ensure that environmental contamination has either not occurred or is fully delineated. All post project environmental sampling should be completed and all test results analysed. Any remediation requirements should be identified and the appropriate approvals to proceed sought from the relevant authorities. The approved remediation should be completed before final reporting to the client.

Appendix K provides a procedure covering all project clearance requirements.

17 STEP 11: PROJECT COST ESTIMATES

The estimated cost of delivering the project to the requirements of the specification should be compared against the available budget. Where insufficient funds are available to complete the project to the design, a review should be carried out with the aim of reducing or eliminating hazardous paint from the project within the cost restraints.

Cost estimates need to be developed by qualified and experienced estimators, with relevant experience in the specific materials and processes to be employed.

18 STEP 12: PROJECT SPECIFIC SPECIFICATION

A project specific specification is a design document for a project which specifies all critical materials and processes required to deliver all of the project objectives. The specification should include reference to all relevant acceptance criteria for workplace and environmental monitoring applicable at the time of writing the specification, including any reporting requirements for exceedances or non-compliances.

Specification writing needs to be carried out by competent persons with long term relevant experience for the type of work involved, assisted as necessary by other specialists such as industrial hygienists or environmental consultants.

The following is a basic list of items which may require addressing:

- (a) Scope of work.
- (b) Overview of project outputs and outcomes.
- (c) Presence, concentration and total mass of hazardous paints.
- (d) Project risk rating assessment.
- (e) Acronyms and references.
- (f) Contractor personnel requirements.
- (g) Quality plan.
- (h) Materials.
- (i) Conditions for commencement of work.
- (j) Paint system.
- (k) Application of paint.
- (l) Access and containment.
- (m) Project clearance and completion.
- (n) Worker management.

- (o) Environmental management.
- (p) Waste management.
- (q) Project clearance plan.
- (r) Inspection and test plan including witness and hold points.
- (s) Paint inspection and surveillance.
- (t) Records of work.
- (u) Warranty.

This list is not definitive and might require addition or deletion of items to suit specific projects.

19 STEP 13: HAZARDOUS PAINT COMPLIANCE PLAN

During the pre-project or tender phase of a project, contractors or other organizations intending to carry out the hazardous paint management works are required to submit a hazardous paint compliance plan (HPCP), to indicate how compliance with all aspects of this Standard and the project specification will be delivered.

Appendix L contains a checklist that should be used when assessing a compliance plan in order to ensure that all elements in the design process have been adequately addressed.

20 STEP 14: PROJECT IMPLEMENTATION

Once a Contractor has been selected and a contract signed, the project should be implemented in accordance with the specification and the contractor's HPCP.

Constant liaison between the contractor, the owner and the specifier will be necessary to ensure that all aspects of the work are progressing satisfactorily or, where necessary, procedures or controls are modified to maintain conformance with the overall project objectives. Any changes to the specified works or controls may only be made with the formal approval of the specifier or owner.

During project implementation, regular contact may also be required with specialist work health and safety, environmental or waste management consultants and all relevant regulatory authorities.

21 STEP 15: COMPLIANCE REPORT

On completion of the project, the contractor, or organization carrying out the hazardous paint management works, is required to prepare a compliance report. This report provides detailed evidence of conformance with all project requirements and this should refer to all of the items contained in the HCPC in Step 13 above.

The report should provide the following as a minimum:

- (a) Full details of all procedures and controls implemented during the project.
- (b) A summary report of all work health and safety and environmental monitoring showing all results and details of any exceedances or non-compliances, including details of workers who were required to be removed from hazardous paint duties due to their medical surveillance results.
- (c) A manifest showing quantities of wastes generated, waste analyses and classification and ultimate disposal of all wastes.
- (d) Any site remediation undertaken by the contractor or the client.

APPENDIX A

PRESENCE AND CONCENTRATION OF HAZARDOUS PIGMENT

(Informative)

A1 SCOPE

This Appendix describes methods for determining the presence and concentration of hazardous metallic pigment in the paint on industrial structures. Two methods are described, one of which involves sampling of paint in the field followed by laboratory testing for any suspected hazardous metallic pigments, whilst the other utilizes a direct measurement of the lead concentration by portable X-Ray fluorescence.

A2 SITE SAMPLING STRATEGY

Regardless of the methods used for the detection of hazardous metals, it is critical that representative test sites be selected for analysis and that sufficient samples are taken to properly characterize the paints on the structure. A sampling plan or strategy should be prepared in advance of sample collection.

When selecting representative test sites, consider the painting history, knowledge of previously applied paints, prior touch-up and repainting programs, differences in the appearance of the paints (e.g. differences in colour or texture which would indicate a different paint type) and other such factors. Apply these judgements to comparable components of the industrial structure (e.g. to all spans of a bridge collectively if possible). The components, or portions of a component, of an industrial structure, which are characterized as having a comparable painting and exposure history, and which are visually similar, are classified as comparable areas.

The plan for the sampling of each comparable area should recognize the following:

- (a) An adequate number of sample sites should be analysed to properly characterize the paints.
- (b) A minimum of three sites should be selected from each comparable area or recognizable paint system on the structure. For example, a minimum of three sites should be analysed from the inside of a water tank and a minimum of three from the outside.

The total surface area coated with the paint being sampled should be calculated or estimated to allow the relevant threshold criteria for each pigment to be determined for the project (from Table 1).

A3 INTERPRETATION OF RESULTS

When one or more tests from a structure or comparable area indicate that one (or more) hazardous metallic pigment is present in excess of the relevant threshold concentrations from Table 1, either the paint on the entire structure should be treated as hazardous, or sufficient additional samples should be analysed to accurately delineate the areas where hazardous paint is present. A project, or part thereof, should not be classified as being free of hazardous metallic pigments unless all samples within the relevant area are shown to be free of hazardous pigments.

A4 FIELD SAMPLING AND LABORATORY TESTING

A4.1 General

Samples should be tested using the analysis techniques and instrumentation which will produce the required accuracy and precision.

A4.2 Analysing for zinc chromate

When analysing for zinc chromate, analysis should be performed for total chromium (chromium III plus chromium VI), rather than for chromate (chromium VI) alone. Total chromium can be determined using the same extract as for the other metal elements whereas chromium VI analysis would require a separate extraction and more complex sampling technique to prevent reduction to chromium III.

If in doubt about whether this were necessary, analysis for zinc and potassium may also be carried out since commercial zinc chromate pigment was usually supplied as zinc potassium chromate. If the ratios for total chromium, zinc and potassium are those found in the commercial pigment, the assumption that all chromium is present as chromate is substantiated. This may not be necessary if a zinc-rich primer is also present.

Alternatively, additional paint samples can be taken for specific analysis to determine the chromium oxidation state (III or VI). Advice for appropriate sampling methodologies and sampling handling/storage should be sought from the analytical laboratory to ensure no reduction of chromium VI to chromium III occurs after sampling.

A4.3 Materials and equipment

The following are required:

- (a) Paint dry film thickness gauge.
- (b) Resealable plastic bags, nominally 200 mm × 100 mm.
- (c) Cutting device preferably with tungsten carbide blade.
- (d) Collection device (e.g. custom funnel) or procedure for collection of paint scrapings.
- (e) Disposable wipes or cleaning detergent and cloths.
- (f) Fresh water.

A4.4 Procedure

The procedure is as follows:

- (a) Wipe and clean the surface of each selected test area to remove all dust and dirt, using disposable wipes, or cloths and detergent.
- (b) Measure the dry film thickness of the paint in the test area.
- (c) Pre-label the sample bag with the relevant information for the location as listed in Paragraph A4.5(a). Attach sample bag to the collection device placed against the surface below the intended sampling area.
- (d) Remove all of the paint within an area of up to 50 mm × 50 mm down to the substrate. Take extreme care to catch all of the scrapings but avoid including substrate in the sample.
- (e) Remove the bag from the collection device then seal the bag and tape it shut to avoid accidental or unauthorized opening.
- (f) Clean all sampling and collection equipment using fresh water and detergent, dry and then repeat Steps (a) to (f) for each location.
- (g) On completion of sampling, arrange for samples to be sent to the analytical laboratory for analysis of the suspected hazardous metallic pigments.

A4.5 Documentation

The following information should be provided:

- (a) *Sample containers* Individually marked to show—
 - (i) project name;
 - (ii) date of sampling; and
 - (iii) any unique field-assigned sample number or description.
- (b) *Chain-of-custody form* To accompany the samples to the laboratory identifying—
 - (i) project name and location;
 - (ii) unique sample number assigned to each sample and date of sample removal;
 - (iii) the laboratory analysis required and the limit of detection;
 - (iv) name of the technician and organization removing the sample; and
 - (v) signatures and dates for each stage in the transfer of the samples from the technician to the laboratory.

A4.6 Report

Report the following minimum information:

- (a) Project name and location.
- (b) Date of testing.
- (c) Name of the technician(s) conducting the testing and/or writing the report.
- (d) Exact location of the test site together with the unique sample number assigned to each sample; include a photograph if possible.
- (e) Paint thickness.
- (f) Size of sample and the presence and amount or thickness of any residual paint left on the surface (preferably zero).
- (g) Laboratory test results, including an interpretation against the threshold criteria in Table 1.
- (h) If the presence of a hazardous pigment has been confirmed, the total surface area covered with the represented paint and the calculated mass of paint represented by the sample.

The report should also contain copies of all chain-of-custody forms and test certificates from the analytical laboratory.

A5 PORTABLE X-RAY FLUORESCENCE (XRF)

A5.1 Principle

Field portable X-ray fluorescence (XRF) analysers are battery operated and have the potential to give a relatively accurate analysis of paint in situ. At present, portable XRF analysers are only available for the accurate analysis of lead in paints.

Portable XRF analysers detect and determine the amount of lead in a painted surface by exposing the paint to high energy radiation (X-rays or gamma rays). Electrons in the metal atoms absorb the radiation and are excited to a higher energy state. When the electron returns to its normal 'stable' energy state, it emits X-ray radiation at a characteristic wavelength, termed X-ray fluorescence.

XRF analysers technically report the result in units of mass per area, usually mg/cm².

A5.2 Equipment

General purpose XRF analysers have the capability of detecting and measuring several elements (spectrum type) and are widely used in metallurgical applications. However, for detecting lead in paint, the XRF analyser is specifically programmed and calibrated for lead in paint. Most XRF lead-paint instruments will nevertheless record a spectrum of detected X-Rays which may be used as a qualitative assessment for other metals or to more fully interpret the reported lead concentration.

Only XRF analysers that utilize a radioactive source to generate the high energy radiation are suitable for detecting lead in industrial paint. Instruments that generate X-rays from an electrical filament (X-ray tube) do not possess sufficient energy to penetrate thick paint layers and detect lead in underlying layers. X-ray tube instruments typically only detect surface lead and will not accurately detect all of the lead in a typical industrial paint film.

The detection limit of XRF analysers is reported to be 0.5 mg/cm². Laboratory analysis can provide confirmation where necessary.

These instruments also have the following characteristics:

- (a) If used over substrates that contain low levels of lead (e.g. old galvanizing) a substrate correction may need to be applied.
- (b) Some elements have X-ray emission energy levels similar to the lead and can cause false positives. For example, bismuth, which is now often used as an inorganic yellow pigment, has a similar emission wavelengths to lead and may be misinterpreted as indicating the presence of lead unless a more detailed examination is made of the total X-Ray emission spectrum.
- (c) The radioactive source has a half-life and requires replacement when detection times become unacceptably long.

A5.3 Procedure

The procedure is as follows:

- (a) Operate the instrument in strict accordance with the manufacturer's instructions.
- (b) Adhere strictly to all safety controls and procedures.
- (c) Before use, the instrument runs its own internal calibration check, and the operator then checks its accuracy against standards of known lead content, provided by the manufacturer.
- (d) A skilled operator is necessary and a licence is required to operate an instrument with a radioactive source.

A5.4 Report

Record the following minimum information:

- (a) Project name and location.
- (b) Date of testing.
- (c) Name of the technician and organization conducting the testing.
- (d) Make and model of instrument used and calibration check results.
- (e) Test site identification/location. Assign a unique number to each test site and identify its specific location on the structure.
- (f) Test results.
- (g) Test areas selected for confirmatory laboratory testing, if required.
- (h) If the presence of a hazardous (lead) pigment has been confirmed, the total surface area covered with the represented paint and the calculated mass of paint represented by the sample.

APPENDIX B

CONDUCTING THE RISK ASSESSMENT

(Informative)

B1 SCOPE

This Appendix provides guidance on conducting an assessment of the degree of risk to other on-site personnel, the public and the environment in the general vicinity, during the disturbance, or removal, of hazardous paints from industrial structures.

B2 GENERAL

The processes in this Appendix provide a detailed risk assessment relating to adjacent workers, public health and the environment, which involves combining a source/release, exposure and dose-response assessment and risk characterization, on a site-specific basis.

Project designers may choose to conduct the detailed assessments described in Paragraph B3 where the specific circumstances of a project warrant such an exhaustive approach. This detailed risk assessment may lead to a more rigorous or less rigorous control of the hazard based upon the specific level of risk involved. For example, low bioavailability or low concentration of hazardous pigment in the paint on a specific project may warrant less rigorous controls than would otherwise be required using the simplified risk assessment.

A simplified procedure for performing a risk assessment of a hazardous paint removal project is given in Paragraphs B4 to B8. The distances nominated in Paragraphs B5, B6 and B7 are recommended for the determination of proximity indicators, in the absence of regulatory requirements, and may vary from structure to structure. Where regulatory requirements are specified by the authority with jurisdiction for the work area, these should be applied.

B3 RISK ASSESSMENT PROCESS

B3.1 General

Risk assessment is a qualitative or quantitative process conducted to characterize the nature and magnitude of risks to workers, public health, or the environment from exposure to hazardous substances released from specific sites. The risk assessment process set out in this Appendix comprises the following four steps:

- (a) Step 1: Source/release assessment.
- (b) Step 2: Exposure assessment.
- (c) Step 3: Dose-response assessment.
- (d) Step 4: Risk characterization.

The goal of risk assessment is to estimate the severity and likelihood of harm to human health or the environment occurring from exposure to a risk agent. It is accomplished through the steps shown in the following Paragraphs (B3.2 to B3.5).

B3.2 Source/release assessment

The first step estimates the amounts, frequencies and locations of the release or escape of risk agents (i.e. hazardous pigments) from specific sources (e.g. a tower repainting project) into occupational, residential or outdoor environments.

B3.3 Exposure assessment

The second step provides qualitative or quantitative data on individuals, populations or ecosystems that are, or may be, exposed to a risk agent (i.e. hazardous pigments), the concentrations of the risk agent and the duration and other characteristics of exposures. Two key elements of the exposure assessment involve identification of the following:

- (a) *Transport mechanisms* These include the following:
 - (i) Environmental media that serve as transport vehicles including waste materials, groundwater, surface water, air, surface or sub-surface soil, sediment and biota.
 - (ii) Transport mechanisms that serve to move contaminants from the source of release to points where exposure can occur, through one or more environmental media.
- (b) *Point of exposure* The point of exposure is a location of potential or actual contact with a contaminated medium. This may include a residence, business, residential yard, playground, campground, waterway or body of water, contaminated drinking water and food sources.

The exposure assessment uses the source/release assessment data from the first step (Paragraph B3.2), to determine how the risk agent disperses in the environment (transport), and identifies and quantifies the point of ultimate contact with a receptor (point of exposure).

B3.4 Dose-response assessment

The third step provides qualitative or quantitative data on the specific amounts of an agent that may reach the organs or tissues of exposed individuals or populations and attempts to estimate the percentage of the exposed populations that might be harmed or injured and, where relevant, the characteristics of such populations (e.g. sensitive subgroups such as children or women of childbearing age). Three key components of the dose-response assessment include the following:

- (a) *Toxicity* This component assesses whether the agent causes an adverse health effect. If so, what are the adverse effects and the doses at which they occur/are assessed.
- (b) *Route of exposure* The means by which the contaminant actually enters or contacts the body is determined (e.g. ingestion, inhalation, dermal contact, or dermal absorption).
- (c) *Receptor population* The persons or species who are exposed or potentially exposed to the contaminants of concern at the point of exposure are determined.

Dose-response evaluation is ultimately the process of evaluating information on toxicity and characterizing the relationship between the dose of the chemical and the incidence of adverse effects occurring in humans or other exposed populations at different exposure levels.

B3.5 Risk characterization

The fourth and final step integrates the results of the previous three steps into a risk statement that includes one or more quantitative estimates of risk.

In general terms, risk is quantitatively approximated by the equation—

$$R = T \times E \quad \dots \text{B3.5}$$

where

R = the risk

T = toxicity

E = exposure

This equation underscores the fact that risk is dependent upon intrinsic toxicity of the material involved and level of exposure, and that to change either, changes the risk. Based upon this model, a simplified version of risk assessment applicable to hazardous paint removal projects has been developed.

B4 PERFORMING THE SIMPLIFIED RISK ASSESSMENT

For each individual project, assessment of the risks to adjacent workers, the public and the environment are conducted, and are then combined to produce the project risk rating. Separate procedures are described in Paragraphs B5 to B7 for conducting the simplified assessment for risk to—

- (a) the public, based upon proximity to the project, and frequency of their presence (see Paragraph B5);
- (b) workers or facility personnel adjacent to a hazardous paint removal project (see Paragraph B6); and
- (c) the environment, based upon the proximity of soil or water (see Paragraph B7).

There is no need to conduct an additional risk assessment for workers who are directly involved in the hazardous paint management process since strict compliance with the procedures for worker protection (see guidance in Appendix I) will ensure assessment of the degree of exposure, level of controls required and monitoring of the adequacy of the controls for such workers.

The project designer should develop a scale plot plan of the project site and surrounding area. The plot plan may need to identify the type of environmental media and all surface features (residences, buildings, playgrounds and other structures) within 750 m of the work site.

B5 PUBLIC HEALTH RISK ASSESSMENT

B5.1 Scope

This method applies to the public at large and includes residents of nearby communities and businesses, transient populations (e.g. visitors to an adjacent park, or the structure itself), and may potentially affect distant populations.

B5.2 Principle

The overall risk to the public health caused by a hazardous paint removal project is established by combining two primary variables, the proximity of the public to the removal project, and the frequency with which the public is present in the proximity of the project site.

B5.3 Materials and equipment

Materials and equipment include the following:

- (a) Site plot plan (to scale).
- (b) Measuring devices.

B5.4 Assessment procedures

B5.4.1 Proximity indicators

The relative proximity of the public to a hazardous paint removal project is a significant variable in determining the potential public health risk. Public areas close to a project, which might be within the likely deposit zone from air dispersion of hazardous dust, would be an obvious concern. Indirect discharges to soil in areas of public use in the vicinity of the project would pose a similar risk.

Conversely, the risk to public health is likely to be minimized if the nearest potential contact with the public is several kilometres from the project. Direct exposure through air deposition would be unlikely to occur as any hazardous dust emitted from the project would tend to settle out long before public contact.

Furthermore, indirect contact would be minimized if the current land use (and likely future use) around the project site ensures that public access is restricted (e.g. the centre of an industrial facility).

In assessing the public health risk, based upon 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 (in metres), and in terms of multiples of the height of the structure on which the 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 (e.g. the method of removal or predominant wind direction).

The proximity indicators are classified as follows:

- (a) *No access* A ‘no access’ proximity indicator is assigned to those projects where the public has no access to, and is more than 750 m from, the removal site (e.g. work in an industrial facility).
- (b) *Far* A ‘far’ proximity indicator is assigned to those projects where the nearest public is beyond the likely dispersion path of hazardous material from the project site via air. In the absence of other information, this may be taken as beyond 300 m, or 5 times the height of the structure, whichever is greater.
- (c) *Moderate* The ‘moderate’ proximity indicator is assigned where the public may be located within the likely dispersion path of hazardous materials via air. This may be considered to be in a range of say, 30 m to 300 m, or up to 5 times the height of the structure, whichever is greater.
- (d) *Close* The ‘close’ proximity indicator is assigned to those projects where the public is located within 30 m of the project site, or within twice the height of the structure, whichever is greater.

B5.4.2 *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, as follows:

- (a) *Never* A ‘never’ frequency indicator is assigned to project sites where the public has no access, (e.g. work in the middle of an industrial facility).
- (b) *Rare* A ‘rare’ frequency indicator is assigned to project sites where the public has restricted access to the area. This value is assigned for controlled commercial sites, and any other areas where the public might be present on a very infrequent basis, (e.g. a remote tank project in a rarely accessed area).
- (c) *Occasional* An ‘occasional’ frequency indicator is assigned to those project sites where the public does not have continuous presence on the site, but would likely be present on an infrequent or short-term basis. This value might be assigned to projects near parks and recreational areas where the public has unrestricted access around the site, but is not present throughout the duration of the removal project. Motorists would also fall into this category.
- (d) *Continual* A ‘continual’ frequency indicator value is assigned to those project sites where identifiable members of the public maintains a relatively full-time presence. This includes, but is not limited to, housing in residential areas, schools, hospitals, and other public buildings.

B5.4.3 Risk to public

The overall risk to the public is established as nil, low, medium or high by combining the proximity and frequency indicators, as in Table B1.

TABLE B1
PUBLIC HEALTH RISK ASSESSMENT

Public proximity	Public proximity indicator	Public frequency indicator			
		Never	Rare	Occasional	Continual
<30 m or 2 × structure height, whichever is greatest	Close	Nil	Medium	High	High
30–300 m or 5 × structure height, whichever is greatest	Moderate	Nil	Low	Medium	High
>300 m or 5 × structure height, whichever is greatest	Far	Nil	Low	Low	Medium
>750 m or no access at all	No access	Nil	Nil	Nil	Nil

B6 ASSESSMENT OF HEALTH RISK TO ADJACENT WORKERS

B6.1 Scope

This procedure applies to adjacent workers within a structure/facility, who may, during their normal scheduled work activities, be at risk of casual (unintentional) exposure to hazardous dust or debris from hazardous paint management activities.

B6.2 Principle

The overall risk to workers who are adjacent to, but not directly involved with, a hazardous paint removal project, is established by combining two primary variables, the proximity of the adjacent worker to the project site and the frequency with which the adjacent worker is in the proximity of the project site.

B6.3 Materials and equipment

Materials and equipment will include the following:

- (a) Site plot plan (to scale).
- (b) Measuring devices.

B6.4 Assessment procedure

B6.4.1 Proximity indicators

The relative proximity of adjacent workers to a removal project is a significant variable in determining the potential adjacent worker health risk. Workers located immediately adjacent to, or under ongoing hazardous paint removal operations, have greater potential risk of exposure than those located further away. Proximity indicators are classed as follows:

- (a) *Far* A ‘far’ proximity indicator is assigned to those projects where the nearest likely adjacent worker is typically beyond 100 m in any direction of the structure.
- (b) *Moderate* A ‘moderate’ proximity indicator is assigned to those projects where the nearest likely adjacent worker is between 15 m and 100 m in any direction of the structure.
- (c) *Close* A ‘close’ proximity indicator is assigned to those projects where the nearest likely adjacent worker is less than 15 m in any direction of the structure.

B6.4.2 Frequency indicators

The frequency with which the worker can be expected to be present in the proximity zone is the second variable for the adjacent worker risk assessment. Frequency indicators are classed as follows:

- (a) *Rare* A 'rare' frequency indicator is assigned to projects where the adjacent workers have no routinely scheduled activities in the project area (e.g. unscheduled maintenance/repair of equipment).
- (b) *Occasional* An 'occasional' frequency indicator is assigned to those projects where adjacent workers have scheduled, periodic stays of less than 2 h/shift in the project area.
- (c) *Continual* A 'continual' frequency indicator is assigned to those projects where adjacent workers have routine, scheduled stays of greater than 2 h/shift in the project area.

B6.4.3 Risk to adjacent workers

The overall risk to adjacent workers is established as nil, low or high, by combining the proximity and frequency indicators, as in Table B2.

TABLE B2
HEALTH RISK TO ADJACENT WORKERS

Worker proximity	Worker proximity indicator	Frequency of presence of personnel		
		Rare	Occasional	Continual
<15 m	Close	Low	Low	High
15 to 100 m	Moderate	Nil	Low	Low
>100 m	Far	Nil	Nil	Nil

B7 ENVIRONMENTAL RISK ASSESSMENT

B7.1 Scope

This method provides a means of assessing the potential environmental impacts of hazardous paint removal operations. In making this judgement, the assessment is directed toward discharges containing hazardous metals directly onto soils and water, or indirectly onto soils and water through air deposits.

B7.2 Principle

The environmental impact is determined by assessing the distance of the media (soils or water) from the project site. As a simplifying assumption, the assessment of potential environmental impact is based solely on distance and is completed by making a determination of whether the closest soil or water to the project site is either distant or near, and therefore the risk is assessed as 'low' or 'high'.

B7.3 Assessment procedure

Removal of hazardous paint, in a location distant from any means of contact with soils or water, such as in the centre of a completely paved large industrial complex, poses a lower environmental risk than the removal of hazardous paint from a bridge located immediately above a waterway. Discharge of hazardous pigment to soil will likely have a longer residence time, and may result in greater overall exposure to the public than when falling into a stream or river where it may be carried away. Discharges to a stream, however, might affect aquatic life or be carried to the shore downstream.

Transfer of contaminants to water from soil discharges could also occur either through stormwater run-off carrying the contaminated materials to surface water, which may then enter drains or streams, or the more protracted process of ground-water contamination. Therefore, assessment of overall environmental impact should consider the proximity of the project site to either soil or water without making a distinction between the two media.

The environmental impact indicators that assign a proximity indicator for the presence of soil or water to the work area are classed as the following:

- (a) *Low* A ‘low’ environmental impact indicator is assigned to those sites where the boundaries of the site and any waterway are more than 60 m or 5 times the height of the structure, whichever is greater, in any direction from the project, and any stormwater drain is plugged until the site is cleared.
- (b) *High* A ‘high’ environmental impact indicator is assigned to those sites where the soils or water, including open stormwater drains, in any direction from the project are within 60 m, or 5 times the height of the structure, whichever is the greater.

B8 PROJECT RISK ASSESSMENT RATING

The project risk assessment rating is determined as follows:

- (a) The public health risk is assessed as nil, low, medium or high as per Paragraph B5.
- (b) The risk to adjacent workers is assessed as nil, low or high as per Paragraph B6.
- (c) The environmental risk is assessed as low or high, as per Paragraph B7.

The three assessments are then combined in the matrix shown in Table B3.

TABLE B3
PROJECT RISK ASSESSMENT RATING

		Risk to adjacent workers					
		Nil	Low	High	Nil	Low	High
Public health risk	High	A	A	A	A	A	A
	Medium	C	B	A	A	A	A
	Low	C	C	A	A	A	A
	Nil	C	C	A	A	A	A
		Low			High		
		Environmental risk					

The risk assessment rating is expressed as A, B or C and this rating is used to determine the emission control requirements for the various hazardous paint management activities. See Appendix D. The risk rating is also used to develop the requirements for containment. See Appendix E.

B9 RECORDS

Documentation for the risk assessment process and outcomes should include the following:

- (a) Site plot plan—A scale plot plan of the project site and surrounding area should be developed. The plot plan should identify the type of environmental media and all relevant features (residences, buildings, playgrounds and other structures) within 750 m in all directions of the site.
- (b) Identification/observations of exposed populations.
- (c) Distances from the project site.