

National Occupational Health and Safety Commission

**NATIONAL GUIDANCE MATERIAL FOR
SPRAY PAINTING**

JUNE 1999

National Occupational Health and Safety Commission
Sydney

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FOREWORD

The National Occupational Health and Safety Commission (NOHSC) is a tripartite body established by the Commonwealth Government to lead and coordinate national efforts to prevent or reduce the incidence and severity of occupational injury and disease by providing healthy and safe working environments. In seeking to improve Australia's occupational health and safety (OHS) performance, NOHSC works to:

- support and add value to efforts in the jurisdictions to tailor approaches to prevention improvement;
- facilitate, through strategic alliances, the development and implementation of better approaches to achieving improved prevention outcomes; and
- integrate the needs of small business into its work.

NOHSC's priorities, as endorsed by the Labour Ministers' Council (LMC) at its meeting on 27 November 1998, are:

- providing comprehensive and accurate national data, particularly to support LMC's comparative performance monitoring;
- facilitating and coordinating research efforts;
- developing and updating a nationally consistent standards framework (subject to LMC agreement);
- coordinating and disseminating information including industry specific practical guidance material; and
- developing a National OHS Improvement Strategy.

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PREFACE

There are a number of hazards to the health and safety of employees engaged in spray painting. Many paints that are sprayed are classified as hazardous, because they contain potentially harmful ingredients. Exposure of employees to these paints can cause injury and illness through inhalation of toxic vapours and mists, and absorption of irritants through the skin. Other hazardous substances that spray painting employees could be exposed to include thinners, degreasers, resins, surface preparation products, dusts from sanding, rust converters and rust removers. Some hazardous substances used in spray painting are also a fire or explosion risk. Other hazards in spray painting include plant, electricity, paint injection from airless spray guns, manual handling and noise.

There are thousands of spray painting employees in Australia. Based on extrapolation from the 1991 Census, the number whose main occupation was vehicle painting was estimated at 13,274 in February 1995¹. Spray painting is also used in the furniture industry and in the painting of ships, aircraft, buildings, structures and machinery. In addition, there are other employees whose main occupation is not painting but who spray paint for part of their time.

It has been estimated that spray painters apply about half of the total Australian production and importation of paint and thinners for local use. Concerns about the adverse health effects of spray painting increased in the late 1980s following evaluation by the International Agency for Research on Cancer, which declared that there was sufficient evidence to show occupational exposure as a painter could be carcinogenic (cause cancer).²

In July 1998, following representation from industry, the National Occupational Health and Safety Commission agreed to publish revised and up-dated reference material on spray painting as the *National Guidance Material for Spray Painting*.

The purpose of this *National Guidance Material for Spray Painting* is to enable a consistent approach to controlling the risks from spray painting. It focuses on the spray painting process, and aims to provide practical guidance on how to achieve a safe working environment through a four step process—hazard identification, risk assessment, risk control and review. This publication applies to all industries where spray painting is carried out, and can be used as a basis for guidance in particular sectors of industry, such as vehicle manufacturers, panel beating shops and furniture manufacturers.

While this publication primarily addresses the hazards of hazardous substances and plant, it also contains limited guidance on controlling the risks from other hazards in spray painting, such as manual handling and noise.

This publication is complementary to the *National Model Regulations for the Control of Workplace Hazardous Substances* and the *National Standard for Plant*. It provides

¹ Australian Bureau of Statistics, Labour Force Estimates, February 1995.

² International Agency for Research on Cancer (IARC), Vol. 47, IARC: Lyon, 1989.

guidance on compliance with the provisions of State, Territory and Commonwealth legislation, based on these publications.

The word ‘must’ is used in this publication when the action described is a requirement from the *National Model Regulations for the Control of Workplace Hazardous Substances* or the *National Standard for Plant*. However, these are legal requirements only if they have been ‘taken up’ in State, Territory or Commonwealth legislation. Requirements can vary between jurisdictions, so employers should check with their local occupational health and safety authority for details of their obligations.

Australian Standards published by Standards Australia are referred to in this publication by their AS number. Full title and reference details for these, and for all other publications referred to, can be found in the Reference List at the back of this publication.

This publication contains boxed information. The information in the boxes is intended to provide guidance on issues discussed in the main text. This publication also contains margin notes. The margin notes refer readers to sources of further information. Icons are used to indicate the different sources of further information referred to. A detailed explanation of margin notes and icons used in this publication appears below.

MARGIN NOTES AND ICONS

Margin notes are used in this publication to refer readers to sources of further information on the subjects being discussed. The following **icons** tell you which source of further information is being referred to:

C

Means more information can be found elsewhere in this publication, and gives a paragraph or page number. For example, **C 6.5** means more information can be found at paragraph 6.5 of this publication.



Means a reference to a National Occupational Health and Safety Commission (formerly Worksafe Australia) publication. These are identified in the margins by their NOHSC number. For example, the *National Model Regulations for the Control of Workplace Hazardous Substances* is referred to in the margin notes as NOHSC:1005 (1994). The Reference List at the back of this publication allows you to look up the titles and other details of referenced publications, using the NOHSC number.

AS

Means an Australian Standard published by Standards Australia. These are always referred to by their AS number, for example, **AS 1715**. The titles and other details of these publications can be found in the Reference List at the back of this publication.

OHS

Means advice should be sought from the local occupational health and safety authority, or that further information is available from that authority. The local occupational health and safety authority is a State or Territory government authority or, for Commonwealth employees, Comcare Australia.



Means for further information see the Reference List.

1. TITLE

1.1 This national guidance material may be cited as the *National Guidance Material for Spray Painting*.

2. PURPOSE

2.1 The purpose of this national guidance material is to assist with the prevention of illness and injury in spray painting work, primarily by providing practical guidance for employers and employees on compliance with State, Territory and Commonwealth legislation that is based on the *National Model Regulations for the Control of Workplace Hazardous Substances* and/or *National Standard for Plant*.



NOHSC:1005
(1994);
NOHSC:1010
(1994)

3. OVERVIEW

HAZARDS IN SPRAY PAINTING WORK

3.1 Spray painting is a hazardous process. The major hazard in spray painting work is hazardous substances. These are substances that can damage people's health. Other hazards in spray painting include:

- spray painting plant;
- dangerous goods;
- electricity;
- noise;
- manual handling; and
- the workplace environment.

C 3.5

C 3.15

C 3.19

SCOPE OF THIS NATIONAL GUIDANCE MATERIAL

3.2 This national guidance material applies primarily to the handling and storage of hazardous substances that are encountered in spray painting processes. These processes include:

- preparation—for example, preparing surfaces, tinting, mixing and pouring paints;
- spray painting;
- storage, clean-up and disposal; and
- the use of spray painting plant—for example, spray booths, compressors and ventilation.

3.3 This national guidance material also contains limited guidance on controlling the risks from some of the other hazards encountered in spray painting.

3.4 This national guidance material does not apply to hot metal spraying, concrete spraying or the use of powdered coatings.

HAZARDOUS SUBSTANCES

What are hazardous substances?

3.5 Hazardous substances are substances that the manufacturer (or importer) has determined are hazardous, in accordance with the National Occupational Health and Safety Commission's *List of Designated Hazardous Substances* or *Approved Criteria for Classifying Hazardous Substances*. Normally, substances can be identified as hazardous by their labels.



NOHSC:10005
(1999);
NOHSC:1008
(1999)

3.6 Broadly speaking, hazardous substances are substances used or stored at the workplace that could damage people's health.

Hazardous substances in spray painting

3.7 Many substances encountered in spray painting are hazardous. They include paints, solvents, dusts, powders, lacquers, paint removers, resins,

C 4.2, 4.14 -
identification of
hazardous
substances.

adhesives, surface preparation products, rust converters and rust removers.

Health effects

3.8 Exposure to the hazardous substances encountered in spray painting can have serious health effects. If exposure is not adequately controlled, health effects can include:

- occupational asthma;
- allergic contact dermatitis;
- lung cancer;
- ‘painter’s syndrome’ which results from long term exposure to organic solvents and affects the brain;
- damage to the reproductive system; and
- kidney or liver damage.

3.9 Shorter term effects can include:

- irritant contact dermatitis;
- burns to the skin or eyes;
- vomiting and diarrhoea;
- irritation to the nose, throat and lungs; and
- headaches, dizziness, nausea and fatigue.

Two pack epoxy coatings

Many products contain a number of different ‘hazardous substances’. An example is two pack epoxy coatings. These may contain organic solvents, epoxy resin and amines. Uncontrolled exposure to **organic solvents**, such as butyl acetate aromatic solvents, can cause headaches, dizziness, nausea and fatigue as short term effects. If the exposure continues, the people being exposed can suffer neurological effects. Gross over-exposure to organic solvents can cause asphyxiation and death. Uncontrolled skin exposure to **epoxy resin** can cause irritation and rashes. Continued exposure can lead to sensitisation of the skin. Uncontrolled short term exposure to some **amines**, for example, the vapours of di ethylene triamine, can cause irritation of the nose, throat, eyes and skin. Long term uncontrolled exposure can cause skin and respiratory sensitisation.

C Box at 5.20 - organic solvents; Figure 6 at 5.13 - sensitisers (substances to which people can become sensitised).

Hazardous substances regulations

3.10 The *National Model Regulations for the Control of Workplace Hazardous Substances* and *National Code of Practice for the Control of Workplace Hazardous Substances* were declared by the National Occupational Health and Safety Commission in December 1993. These publications aim to ensure that the health risks of workplace hazardous substances are effectively controlled.



NOHSC:1005 (1994);
NOHSC:2007 (1994)

3.11 The national model regulations have been, or will be, taken up in State, Territory and Commonwealth legislation. This means that generally the provisions of the national model regulations will become mandatory for all employers. Currently some jurisdictions list certain hazardous substances that are prohibited in spray painting in their respective hazardous substances legislation. Always seek advice from your local occupational health and safety authority about which hazardous substances are prohibited from use.

3.12 Generally, employers' obligations under State, Territory and Commonwealth legislation based on the national model regulations include:

- consultation with employees;
- providing information and training to employees;
- identifying the hazardous substances used or stored at the workplace;
- assessing the risks from hazardous substances;
- controlling the risks of hazardous substances;
- arranging atmospheric monitoring and health surveillance where necessary; and
- record keeping.

3.13 Employees' obligations include:

- complying, as far as they are able, with all activities carried out in accordance with relevant hazardous substances legislation; and
- reporting promptly to their employer anything that they become aware of that could affect the employer's compliance with relevant hazardous substances legislation.

3.14 In summary, this national guidance material contains practical guidance for spray painting employers and employees on compliance with State, Territory and Commonwealth legislative provisions based on the *National Model Regulations for the Control of Workplace Hazardous Substances* and *National Code of Practice for the Control of Workplace Hazardous Substances*.

Hazardous substances that are prohibited in spray painting

Currently some jurisdictions list certain hazardous substances that are prohibited in spray painting in their respective hazardous substances legislation. Always seek advice from your local occupational health and safety authority about which hazardous substances are prohibited from use.

SPRAY PAINTING PLANT

What is plant?

3.15 'Plant' includes machinery, tools, appliances and equipment. In spray painting, examples of plant include spray painting guns, spray booths, pumps, ventilation systems, compressors and hoses.

3.16 The *National Standard for Plant* contains detailed requirements for the installation, inspection, maintenance and use of workplace plant. The national standard has been, or will be, taken up in State, Territory and Commonwealth legislation. There are variations in the application of the national standard in each State and Territory. Guidance on applying the national standard can also be found in the National Occupational Health and Safety Commission's *Plant in the Workplace—Making It Safe: A guide to managing risks from plant in the workplace for employers and employees*.

OHS

In occupational health and safety, Commonwealth legislation is usually only relevant to Commonwealth employers and employees. For most employers and employees, State or Territory legislation applies.



*NOHSC:1010
(1994)*

OHS



Plant hazards

3.17 Plant is a major cause of workplace injury and illness in Australia. Hazards from spray painting plant can include:

- exposure to hazardous substances, for example, if ventilation malfunctions;
- heat overload;
- electric shock or electrocution;
- noise; and
- cutting, bruising, crushing or severing parts of the body.

3.18 Another source of injury from plant in spray painting is injection injury. This can happen when using high pressure airless spraying equipment. A substance is injected into the bloodstream which can cause a lack of blood supply to the area, or chemical or thermal burns. In some cases, injection injuries have led to the amputation of fingers or hands.

DANGEROUS GOODS

3.19 Some hazardous substances are also classified as dangerous goods, including, for example, poisons, corrosives, flammable and explosive substances. Separate State, Territory and Commonwealth regulations apply to the handling, storage and transport of these substances. Employers should contact their local occupational health and safety authority about dangerous goods requirements.

OTHER HAZARDS IN SPRAY PAINTING

3.20 Other hazards in spray painting include explosion, manual handling, confined spaces and the workplace environment, that is, the design and cleanliness of the workplace. Most of these are not addressed in detail by this national guidance material. However, State, Territory and Commonwealth regulations and codes of practice exist for some of them.

HOW TO ENSURE HEALTH AND SAFETY

Management systems

3.21 Management systems are the systems used to operate a business. The object of systems is to make sure everything gets done and everyone knows what to do. For example, there might be systems for purchasing, work operations, disposal of substances, paying salaries and maintaining equipment. To ensure your workplace does not put employees (or others) at risk, health and safety should be taken into account in all management systems used.

3.22 Specific responsibilities for health and safety should be set by the employer, and communicated to all employees. It must be clear who is responsible for doing what. For example, one person might be responsible for making sure the exhaust ventilation is regularly cleaned and maintained. Another person might be responsible for making sure waste is disposed of appropriately.

OHS

A national standard and code of practice for dangerous goods is currently being developed by the National Occupational Health and Safety Commission.

OHS

3.23 If the workplace and work activities are designed with health and safety in mind, then hazards can be eliminated from the beginning. This is much easier than trying to minimise risks once the hazards are already present. An example is buying equipment that is not a noise hazard, so employees' hearing will not be at risk.

3.24 To effectively control existing risks, the following four step process should be used.

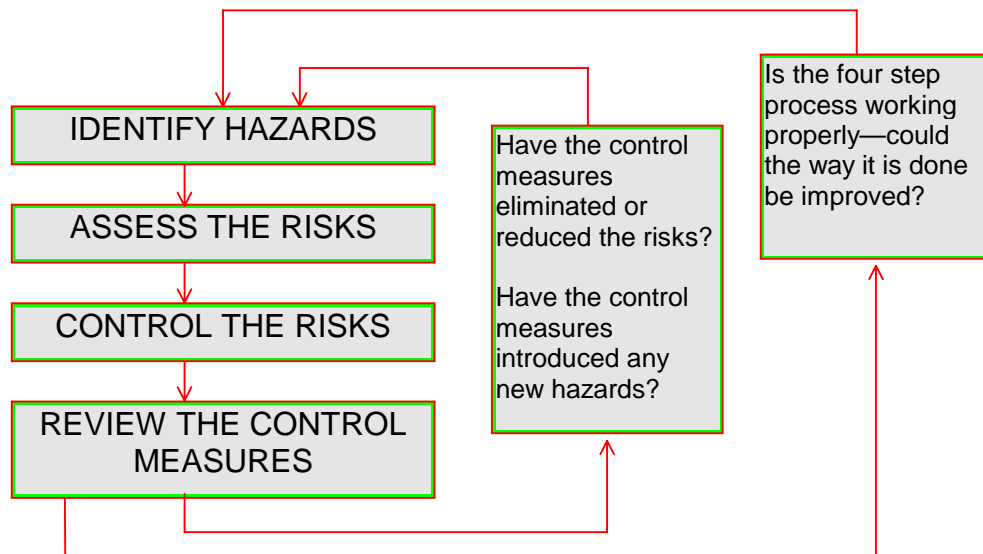


Figure 1—*The four step process for risk control*

3.25 This process should be carried out in consultation with employees. Guidance on each step in the process can be found in Chapters 4–7.

Consultation

3.26 Consultation is the sharing of views, and exchange of information, between employers and employees, and/or their representatives. Although the responsibility for health and safety decisions rests with the employer, consultation means employees can contribute useful and timely suggestions based on their experience. This can lead to better-informed decision making and problem solving. When employees are consulted, problems can often be pre-empted or resolved on the spot. Consultation also helps to create awareness and build commitment to effective risk control.

3.27 Employees and their representatives should participate in the four step process for risk control, and decisions about training. Employees and their representatives should also be consulted before any changes are made at the workplace that could affect health and safety. Consultation should begin as early as possible during planning for the change, and should continue until and during its introduction. In this way, health and safety considerations can be

incorporated with the change, harmful consequences can be avoided, and better systems and processes can be put in place.

3.28 Employers should give employees health and safety information about any changes planned prior to consultation. This allows employees time to consider the information so that they can contribute meaningfully to discussions. Employees should also be involved in reviewing the effects of the change.

3.29 In larger workplaces, a formal process may be needed for consultation. The process should be developed by the employer and employee representatives.

4. HAZARD IDENTIFICATION

4.1 A hazard is something that could cause harm, that is, injury or illness. Employers must identify spray painting hazards in consultation with employees.

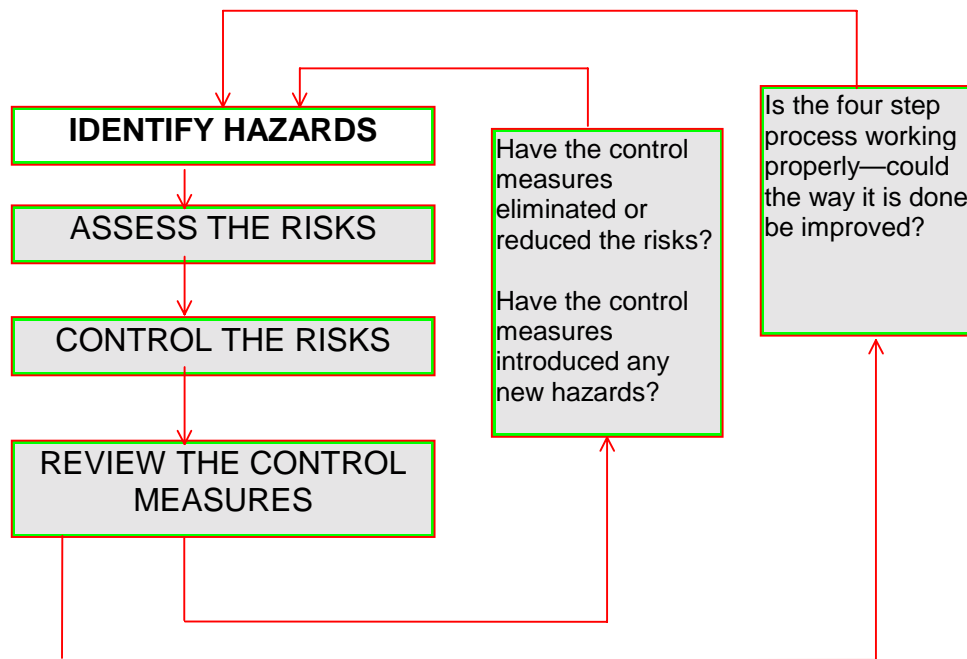


Figure 2—Hazard identification is the first step in the four step process

IDENTIFYING HAZARDOUS SUBSTANCES

4.2 A hazardous substance can be identified by its label and Material Safety Data Sheet (MSDS). Employers must make sure that:

- all substances in the workplace are correctly labelled; and
- health and safety information about the substances, including an MSDS, has been obtained from the supplier, importer or manufacturer.

Hazardous substances that are prohibited in spray painting

Currently some jurisdictions list certain hazardous substances that are prohibited in spray painting in their respective hazardous substances legislation. Always seek advice from your local occupational health and safety authority about which hazardous substances are prohibited from use.

C 4.14 - the hazard identification process.

Material Safety Data Sheets

The MSDS contains information about a substance, including its identity, health hazards, precautions for use and safe handling. See 4.10 for how to obtain an MSDS. Guidance on interpreting MSDS can be found at Appendix 1.

Labelling

4.3 Labels can become unreadable through paint spillage or other damage. Therefore, employers should:

- a) instruct employees to read the label before opening a container;
- b) take reasonable care not to spill the contents so that the label is not covered or destroyed (replace any labels that become unreadable); and
- c) not allow anyone to remove, deface or alter a correct label.

4.4 If an employer finds a container that does not have a label or is improperly labelled, action should be taken to label it correctly.

4.5 If the contents of the container are not known, this should be clearly marked on the container, for example, 'Caution do not use: unknown substance'. Such a container should be stored in isolation until its contents can be identified and, if hazardous, the container is appropriately labelled. If the contents cannot be identified, they should be disposed of in accordance with local regulations.

4.6 When a paint or thinner is poured from one container into another ('decanted'), the labelling required depends on whether the substance is used immediately or over a longer period. If a decanted substance is not used immediately, the employer must ensure that the container into which it is decanted is labelled with the product name and the risk and safety phrases.

Risk and safety phrases

Risk and safety phrases are standardised information on labels, for example 'irritating to eyes', 'explosive when dry', 'do not empty into drains', 'keep out of reach of children' and so on.

4.7 When labelling is required but the container into which the substance is decanted is very small, for example, a test sample, the label may be attached to supporting apparatus. Alternatively, a tag may be used to provide the required information.

4.8 When a decanted substance is used immediately, no labelling is required provided that the container is cleaned after use so that it no longer contains the substance.



*NOHSC:1005
(1994);
NOHSC:2007
(1994).
Labelling is the
responsibility of
suppliers.
Labels should be in
accordance with
NOHSC:2012
(1994).*

Hazardous substances in enclosed systems

4.9 If a hazardous substance is contained in an enclosed system, such as an airless spray system or recirculating paint system, people should be alerted to its presence by appropriate signage.

Material Safety Data Sheets

4.10 Employers must obtain current MSDS for all hazardous substances supplied to the workplace. MSDS can be obtained from the supplier, importer or manufacturer.

Information on hazardous substances from manufacturers, importers and suppliers

The **manufacturer** or **importer** is responsible for determining which substances are hazardous, and for producing MSDS for those substances.

The **supplier** of hazardous substances is responsible for correct labelling of the substance, and for providing the purchaser with health and safety information about it.

The health and safety information suppliers have to provide includes a current MSDS and any further information they may have regarding safe use of the substance. Suppliers must provide this information:

- on or before the first supply of a substance;
- if the MSDS is updated; and
- on request from purchasers or prospective purchasers.

Retailers are not included in the definition of 'supplier', so they do not have to provide MSDS to purchasers at retail outlets. If a hazardous substance is bought from a retailer and the MSDS is not available, then a copy can be obtained on request from the manufacturer or importer.

4.11 Employees and their representatives must have easy access to the MSDS.

4.12 MSDS obtained from the manufacturer, importer or supplier must not be altered. The only exceptions are when an MSDS is provided from overseas and is not in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets*, or when additional information is added to the MSDS. Any alterations or additions to an MSDS in these cases must be clearly marked to indicate that they were not part of the original MSDS.

Health and safety information for substances produced in the workplace

4.13 If a hazardous substance is produced in the workplace, for example, by mixing, and an MSDS is not available, employers should obtain information about the health effects, precautions for use and safe handling of the substance. This information should be provided to employees or their representatives.

AS Signage in accordance with AS 1319 or AS 1345 is suitable.

C 3.7 - types of hazardous substances associated with spray painting.



NOHSC:1005 (1994);
NOHSC:2007 (1994);
NOHSC:2011 (1994)

C 4.20 - Hazardous Substances Register.

NICNAS summary reports
 National Industrial Chemicals Notification and Assessment Scheme (NICNAS) summary reports are one source of information on hazardous substances. These reports are produced under the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth). If a NICNAS summary is available on a workplace substance, then the employer should obtain a copy and provide the information to employees or employee representatives.

The identification process

4.14 The employer, together with employees, should identify all hazardous substances used or produced in the workplace.

4.15 Hazardous substances can be identified by their labels, MSDS or equivalent information. Hazardous substances in enclosed systems can be identified by their signage.

C 4.13 - equivalent information.

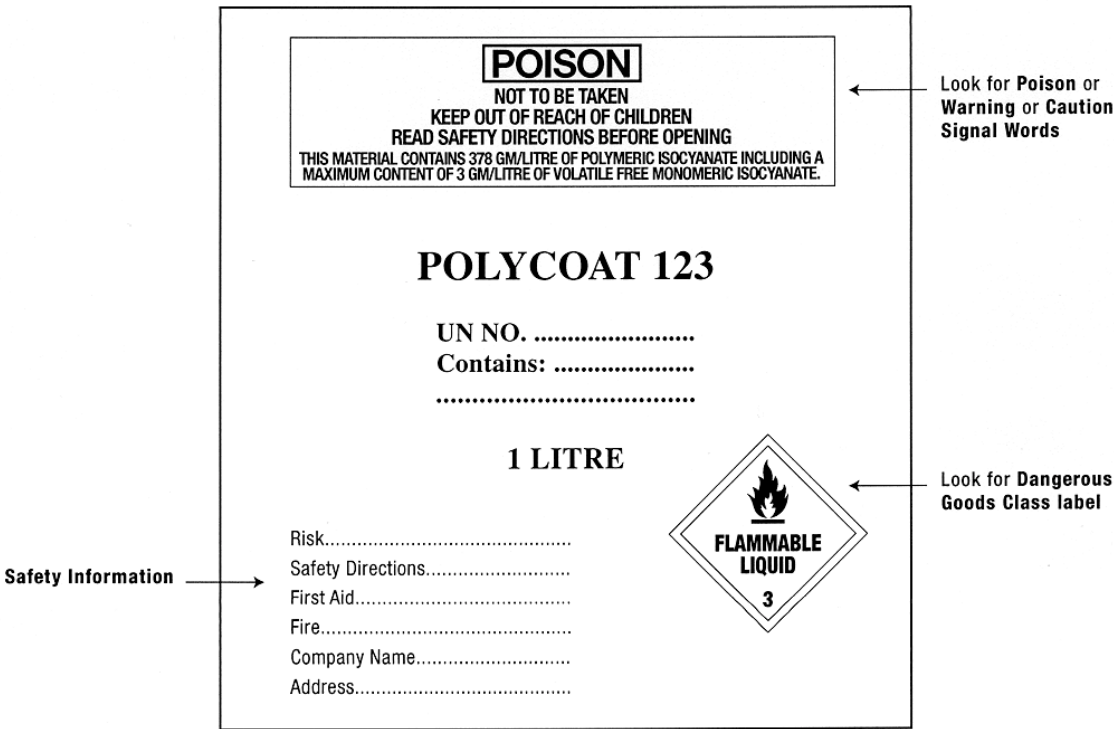


Figure 3—Sample label showing two hazardous substance ‘signals’

4.16 The words ‘POISON’ or ‘DANGEROUS POISON’, boxed and in capitals at the top of the label, or a Dangerous Goods Class ‘diamond’ on the label, are signals that the substance may be hazardous. If these signals are not present, then the word ‘HAZARDOUS’ should be, if the substance is hazardous. Substances with ‘CAUTION’ or ‘WARNING’, boxed and in capitals at the top of the label, may also be hazardous. Refer to the MSDS, or contact the supplier, importer or manufacturer for more information on these substances.

4.17 The MSDS should contain detailed information about a substance, including health hazards.

4.18 There should be enough information in the MSDS to determine whether a substance could release another hazardous substance during normal use.

4.19 Identification of hazardous substances should take into account the dusts that are generated by sanding and grinding operations. Some of these dusts can be hazardous, for example, if they contain lead, tributyltin oxide or hexavalent chromium. Sanding of polyurethane paints that are not fully cured generates dust containing unreacted isocyanate. Inhalation of isocyanates can lead to long term respiratory problems.

Hazardous Substances Registers

4.20 Employers must keep a register of all hazardous substances used or produced at the workplace. The minimum information that has to be included in the register is a list of the hazardous substances and copies of their MSDS or the equivalent information.

C 4.13 -
equivalent
information.

4.21 The register must be kept up to date. If new substances are introduced, they must be added to the register. If an MSDS is revised, the earlier version should be replaced with the new one. If a substance is no longer used, it should be deleted from the list and its MSDS removed. Any additional information that is obtained about substances can also be included in the register.

4.22 Employees, employee representatives, emergency services and the relevant public authorities must have ready access to the register.

Information for emergency services

Emergency services must be given hazard information about any location where hazardous substances are used, produced, stored or disposed of. They should also be given information on the location of fire hydrants, the register and emergency response plan.

IDENTIFYING HAZARDS FROM PLANT

4.23 Identification of hazards from plant is a matter of considering whether anyone could be harmed by interaction with each item of plant in the workplace. This should take into account the systems of work used with the plant.

4.24 Hazard identification is assisted by:

- a walk through inspection of plant in the workplace and discussion with employees;

- examination of injury, illness or incident records, including health surveillance records; and
- manufacturers' instructions and advice.

4.25 As well as identifying hazards that could arise during the normal use of spray painting plant, hazards should also be identified when:

- introducing new plant;
- modifications are made to the plant;
- using the same plant differently;
- using the same plant in a different place;
- using the plant in unusual circumstances; and
- if new information about the plant becomes available. (This information can be obtained, for example, through trade journals, employer associations, the occupational health and safety authority, research or networking.)



Figure 4—*Inspection of empty spray apparatus shows that there is a hole in the supply line*

4.26 Employers should give employees and employee representatives health and safety information about spray painting plant. This information should include what the plant is designed for and how to use it safely. Results of any safety testing of the plant should also be included.

4.27 Suppliers, importers, manufacturers and designers of plant are legally obliged to provide health and safety information about it.

IDENTIFICATION OF OTHER SPRAY PAINTING HAZARDS

4.28 Although hazards other than hazardous substances and plant are not addressed in detail in this national guidance material, it is likely to be practical for employers and employees to identify them at the same time as they look at hazardous substances and plant. The procedure described in 4.24 above should be used.

4.29 Brief information on some of the other hazards is provided below.

Fire, explosion and electrical hazards

4.30 Spray painting disperses more paint into the atmosphere than other methods of application. Many paints contain flammable substances. Spray painting mists spread and rapidly fill air space, where they may come into contact with many potential sources of ignition, for example, static electricity, sparks, flames and hot surfaces.

4.31 Electrical installations and use of electrical equipment are hazards in spray painting areas and paint mixing and storage areas. An immediate hazard is created if electrical equipment that is damaged, or not designed to provide explosion protection, is operated in these areas. Spray painting in general can involve electrical equipment which, if not properly installed or not regularly maintained, can result in electrical or explosion hazards.

4.32 Static electricity charges can be generated in any spray painting process if two differently charged materials come into contact. An example is that touching two metal cans together during decanting can create a static spark. This can be enough to ignite flammable materials.

4.33 Incorrectly stored flammable materials are a hazard. Any build-up of paint residue in work areas or on equipment is also a hazard as it may be flammable. Paint and solvent soaked rags can spontaneously burst into flames if they are not wet and safely contained after use.

4.34 Water can conduct electricity from electrical equipment to people. Wet work, for example, wet rubbing, in an area where electrical equipment is being used can lead to electrical shock or electrocution.

4.35 Electrical shock or electrocution can also be associated with electrostatic spray painting.

*C Appendix 5 -
Duties of
Suppliers,
Importers,
Manufacturers
and Designers of
Plant.*

OHS

*C 6.20, 6.23,
6.36–6.39,
6.47–6.53, 6.59,
6.63*

*C Appendix 4 -
Special Control
Measures for
Electrostatic
Spray Painting.*

4.36 Combustion motors should not be in a spray painting area while they are running.

Confined spaces

4.37 Paint vapours and mists build up rapidly in confined spaces. This increases the risk of exposure to hazardous substances and fire or explosion.

Noise

4.38 Sources of noise can include pumps, electrical motors, compressed air spraying or the spray booth. Exposure to high noise levels can result in hearing impairment or occupational deafness. Noise also affects concentration and may lead to incorrect decisions being made. In addition, noise can make communication difficult and may mask warnings.

Manual handling

4.39 Poorly designed equipment and tasks that require stretching, bending and twisting of the body are manual handling hazards. For example, holding the spray painting gun in a static position above shoulder height places the body under considerable stress and strain, and may result in manual handling injury. Pushing or pulling vehicles or other objects to be painted can also put people at risk.

Workplace environment

4.40 If the workplace is not well designed and maintained, injury or illness can result. Factors that should be considered include lighting, cleanliness, storage, the possibility of slips and trips, working at heights, temperature, first aid and the availability and location of amenities.

House keeping

4.41 For safety and efficiency, a high standard of house keeping is required.

Personal protective equipment

4.42 Hazards with personal protective equipment (PPE) are associated with lack of maintenance, poor storage practices and improper use. Maintenance, storage and use practices are critical for risk control. The following practices should be followed for PPE:

- PPE should be on personal issue and marked with the name of the individual to whom it has been allocated;
- PPE should be cleaned daily and checked for defects;
- PPE should be stored in an airtight container;
- cartridges should be dated and changed regularly, where applicable;
- replacements should be readily available;
- operators should be properly trained;
- operators should be clean-shaven for adequate face seal; and
- airline filters should be changed as required.

C 6.35



*NOHSC:1001
(1990);
NOHSC:2005
(1990).*

C *Appendix 7 -
Personal
Protective
Equipment
Required under
Different
Ventilation
Conditions.*

5. RISK ASSESSMENT

5.1 Risk is the likelihood that a hazard will cause harm. Employers, in consultation with employees, must assess the risks of the spray painting hazards that they have identified. The purpose of this is to determine the level of risk and how well the risks are being controlled.

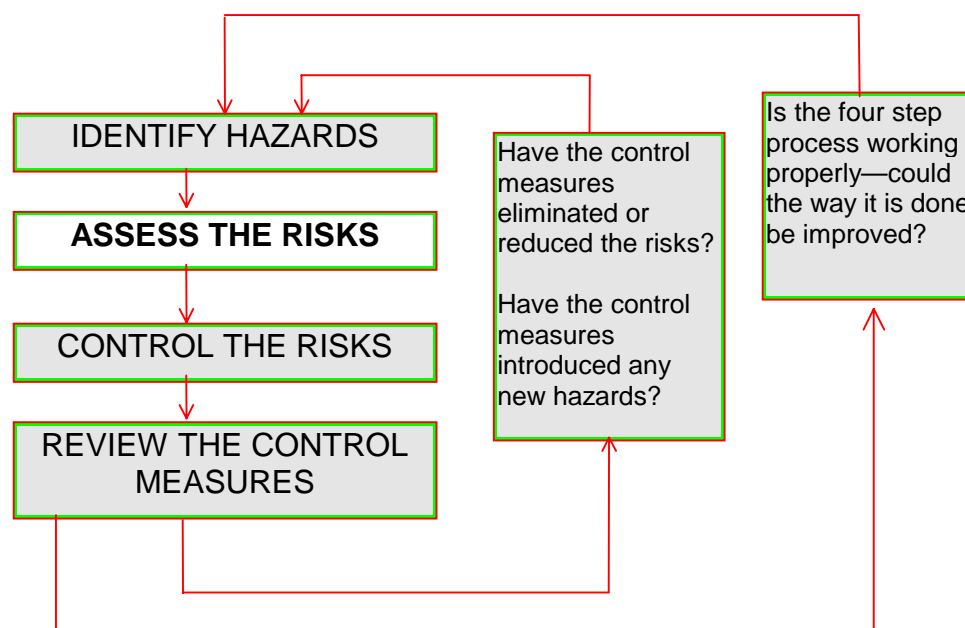


Figure 5—Risk assessment is the second step in the four step process

5.2 Assessment involves working out the level of risk from each hazard. The level of risk depends on both the **nature of the hazard** and **the way people interact with the hazard**.

THE NATURE OF THE HAZARD

5.3 The nature of the hazard should be considered in terms of how it could do harm and how severe that harm would be. For example, could it do harm by crushing or cutting, being inhaled, becoming electrified, being noisy, exploding? How severe would that harm be—could someone be killed or suffer chronic health effects, or could it cause minor injuries such as cuts and bruises?

5.4 Hazardous substances used in painting and preparation processes can do harm if people are directly exposed to them. Exposure can occur through different 'routes of entry' into the body. Routes of entry include inhalation (breathing it in), skin contact, ingestion (swallowing it), eye contact and injection through high pressure equipment. Depending on the substance, the severity of the harm could range from minor to major, for example, from minor skin irritation to chronic lung disease.

Inhalation hazards in spray painting

Hazardous substances can be inhaled as soon as the container is open.

Many hazardous substances used in spray painting are volatile, that is, they evaporate quickly. The resulting vapours can then be inhaled. For example, the basis for the curing and drying of many paints is the evaporation of organic solvents.

In addition, the spray painting process converts substances to aerosol form. Aerosols are very small droplets of liquid in the air. Aerosols can be inhaled. This means that there is potential exposure through not only the vapours from evaporation but also the aerosols.

5.5 All potential types of harm from each hazard need to be considered. For example, some substances are a risk because they can cause diseases and also because they are flammable. Some items of plant are a risk because they are very noisy, produce sparks and are capable of cutting people.

THE WAY PEOPLE INTERACT WITH THE HAZARD

5.6 The way people interact with a hazard influences risk. Consideration of the interaction involves looking at:

- the number of people who could be exposed to the hazard;
- how often and for how long they could be exposed; and
- whether the existing methods of controlling the risks from each hazard are adequate, that is, whether people actually are being exposed.

Example of the way people interact with the hazard

There are five employees regularly spraying paints that can cause serious health effects. The employees are spending at least half their time at work using these paints. The nature of the paints makes this a potentially high risk. The number of employees involved and the number of hours spent working with or near the sprayed paint increase the risk. However, if adequate control measures are in place, then the probability of severe effects is reduced.

For instance, if the painting is always done in a properly designed, well-maintained spray booth, using safe and well-maintained equipment, following health and safety procedures, and wearing suitable PPE, then employees are less likely to be directly exposed and the risk is reduced. On the other hand, if the employees are regularly exposed to vapours and aerosols because adequate control measures are not in place, then the probability of severe effects is increased.

ESTIMATING THE LEVEL OF RISK

5.7 The level of risk from each hazard is a combination of the nature of the hazard and the way people interact with it. The risk is greater when the harm a hazard could do is more severe. The risk is also greater if interaction with a hazard increases the likelihood of exposure.

5.8 Broadly speaking, risk levels can be low, medium or high.

	Interaction with hazard makes it highly likely harm will occur	Interaction with hazard makes it reasonably likely harm will occur	Interaction with hazard makes it unlikely that harm will occur
Potential for harm from exposure to the hazard is high	HIGH RISK	HIGH RISK	MEDIUM TO HIGH RISK
Potential for harm from exposure to the hazard is moderate	HIGH RISK	MEDIUM TO HIGH RISK	MEDIUM RISK
Potential for harm from exposure to the hazard is low	MEDIUM RISK	MEDIUM TO LOW RISK	LOW RISK

Table 1—*The level of risk can be estimated by ‘combining’ the potential harm from the hazard with the likelihood that the hazard will do harm*

5.9 While all risks need to be controlled, ‘high’ risks should be the first priority. Results of the assessment are the basis for planning and putting in place an effective risk control program. The assessment will also show whether atmospheric monitoring of hazardous substances and employee health surveillance are required.

RISK ASSESSMENT OF WORK WITH HAZARDOUS SUBSTANCES

Employers’ responsibilities

5.10 Employers must ensure that an assessment, as described in this national guidance material, is made of all spray painting work involving potential exposure to any hazardous substance.

Exposure standards

5.11 Exposure to hazardous substances **must not be greater** than the standards listed in *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*. Exposure standards refer to airborne concentrations of substances, and represent conditions under which it is believed nearly all employees can be repeatedly exposed day after day without adverse effect.

5.12 Risk assessment therefore includes determining whether it is likely that exposure standards are being exceeded or approached. Air monitoring may be needed for this.

C 5.10 - risk assessment of work with hazardous substances; 5.48 - risk assessment of plant.

C Chapter 6 - Risk Control; 5.34 - monitoring; 5.42 and Chapter 9 - Health Surveillance.



NOHSC:1003 (1995);
NOHSC:3008 (1995)

C 5.34

5.15 Employers can do the assessment themselves, in consultation with employees, or they might delegate the task to one or more employees with sufficient skills. If necessary, professional assistance can be sought from occupational hygienists or other relevant specialists.

OHS authorities, employer associations and unions may also be able to help.

Stages in the assessment of work with hazardous substances

5.16 A practical way to carry out assessments is to divide workplace activities into jobs, tasks or work areas and assess the risks involved in each. The assessment can then be completed in four stages.

First stage

5.17 The first stage is to list the hazardous substances used or produced in each job, task or work area.

5.18 As well as paints, 'hazardous substances' could include, for example, solvents used for cleaning, resins, thinners, surface preparation products, powders, adhesives, paint removers, rust converters and rust removers.

Second stage

5.19 The second stage is to review the label and the MSDS or equivalent information for each substance to determine the nature of the hazard. The risk phrases on the label are a guide to the type and seriousness of the harm a substance can do.

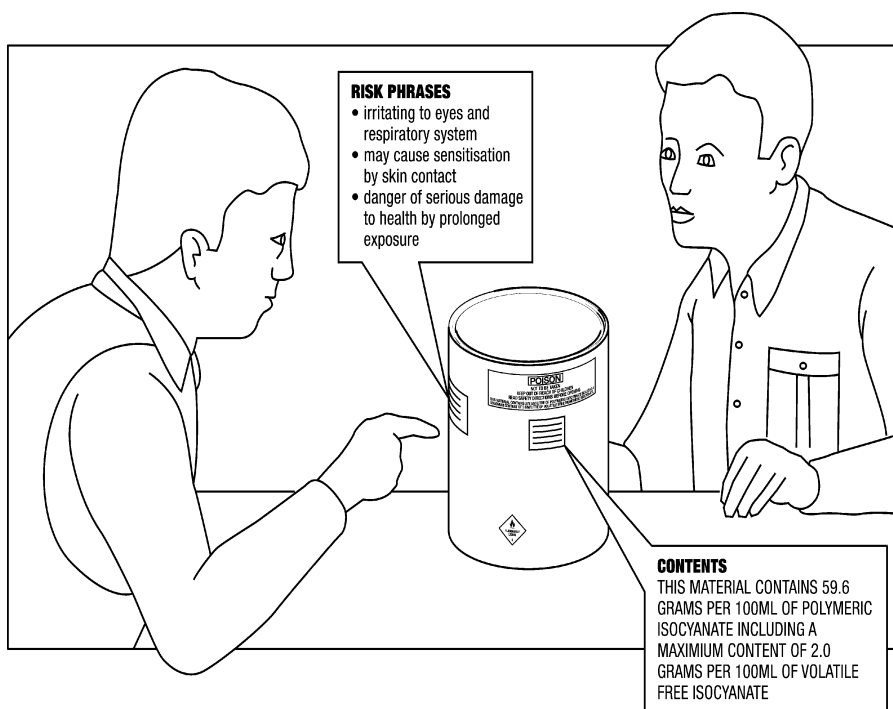


Figure 7—*Contents information and risk phrases can be found on the label*

More detailed information on possible harm from a substance can be found in the MSDS.



*NOHSC:3017
(1994)*

5.20 Using information from the label and MSDS, spray painting substances can be put into three hazard categories as follows:

- a) **Category 1—High hazard** includes substances that **contain or are**:
- i) cancer-causing chemicals, for example, coal tar;
 - ii) skin or respiratory sensitisers, for example, isocyanates in polyurethane paints;
 - iii) mutagens or reproductive hazards, for example, ethoxyethyl acetate;
 - iv) substances which cause severe effects after repeated or prolonged exposure, for example, styrene;
 - v) metallic hazardous substances, for example, cadmium;
 - vi) substances which cause acute lethal or non-lethal irreversible effects after a single exposure;
 - vii) substances which cause acute irritant effects;
 - viii) classified as Schedule 6 or 7 poisons;
 - ix) corrosive substances or Dangerous Goods Class 8 products;
 - x) Dangerous Goods Class 5 products; or
 - xi) two (or more) pack paints, for example, a polyurethane paint and its hardener.
- b) **Category 2—Medium hazard** includes any substance that contains organic solvents, or is a Dangerous Goods Class 3 product, that is not already included in Category 1. This can include water-based paints.
- c) **Category 3—Low hazard** includes any other substances not in Categories 1 and 2.

Organic solvents

Except for water, which is an inorganic solvent, the vast majority of solvents used at work or contained in workplace substances are organic. 'Organic solvents' covers a broad range of different substances, for example, toluene, xylene, methyl ethyl ketone, acetone, benzene, ethylene glycol derivatives, turpentine and white spirit. Their potential health effects vary, with some being more hazardous than others. Most of them are flammable. It should not be assumed that water-based paints and other water-based products are non-hazardous, because many contain organic solvents or other hazardous substances.

C Appendix 1 - Interpreting MSDS; Appendix 2 - information on how to identify these substances from the label and MSDS, and more examples of each type.

A mutagen is a substance that can cause genetic mutation, that is, alter a person's genes. A teratogen is a substance that can damage the foetus and lead to birth defects.

OHS

Dangerous goods information.

5.21 Determining which category a substance is in will help with assessing risk. It will also help with decisions about risk control.

Third stage

5.22 The third stage is to inspect the relevant work area/s to find out whether people are being exposed because of the way they are interacting with the substances being used. This involves:

- a) Discussion with employees about work practices and procedures.
- b) Determining whether substances are being released into the work area. This includes noting:
 - i) Evidence of contamination, for example, dust or fumes visible in the air or on surfaces, a substance visible on a person's skin or clothing, the odour of substances, visible leaks, spills, splashes or residues. (While odour can indicate a problem, if there is no odour that does not mean that there is no problem. Odour is not a reliable indicator of whether the amount of a substance present is above or below the exposure standard.)
 - ii) Employees' experience or symptoms of exposure. As well as ill health or injury, symptoms of exposure can include recurring irritations, for example, feelings of discomfort or respiratory problems. While these symptoms may not seem serious at the time, they can indicate, or become, long term health effects.
- c) Consideration of all persons potentially exposed, including, for example, people who pass through the area, cleaners and maintenance workers.
- d) Consideration of the effects of unusual or particular circumstances, such as staff shortages, environmental conditions, weather changes, equipment repair, very busy times and emergencies. For example, if there is smoke outside near the fresh air inlet, it could be drawn into the spray booth.
- e) Consideration of the combined effects of two or more hazardous substances.
- f) Estimation of the degree of exposure for all persons potentially exposed. The estimation should take into account the level, frequency, and duration of exposure, as well as the different routes of entry. If the degree of exposure cannot be estimated with confidence, then monitoring or health surveillance may be required.



NOHSC:3017
(1994)

C 5.34 - monitoring;
5.42 and Chapter 9 -
Health Surveillance.

- g) Consideration of existing control measures, including whether:
- i) Controls are in place, effective and well maintained.
 - ii) Employees have been trained in the proper use and maintenance of the controls.

Influence on risk of the object being sprayed

The object being sprayed can influence risk. These factors should be considered:

- the position of the object in relation to the painter;
- the positioning of other employees;
- the direction of the stream of ventilating air;
- the size and shape of the object; and
- the ease of moving the object.

What must be avoided is positioning the object so that painters have to spray towards each other, towards other employees or up wind of other employees.

See Figures 8–11 on the following pages.

Influence on risk of the spray painting process used

The spray painting process used also influences risk. Characteristics of the different processes are as follows:

- **Conventional compressed air (low pressure) spray painting**—Extensive overspray; bounce in cavities and at corners (rebound); high sound levels.
- **Airless (high pressure) spray painting**—Less overspray, bounce and aerosol than conventional air spraying; relatively high viscosity paints can be used (less solvent is needed in the paint); higher capacity (flow rate) and faster application; risk of injection injury and static electricity that could cause a spark.
- **Air assisted airless (combined method) spray painting**—Less aerosol and overspray than conventional air spraying; risk of injection injury.
- **Electrostatic spray painting**—Spray guns heavier and more difficult to handle; static electricity (see Appendix 4).
- **Hot spraying**—Uses very little thinner; reduced overspray; increased fire or explosion potential.
- **Pressure pots**—Risks from overpressurisation (pressure must be released before opening to refill); damaged vessels and incorrectly fitted hoses and couplings; awkward manual handling; more solvents used in maintenance.

Fourth stage

5.23 The fourth stage is to evaluate the risks for each job, task or work area. More information on this is can be found below.

5.24 Risks of work with hazardous substances can be assessed as high, medium, low or uncertain. An explanation of these four risk levels is given below:

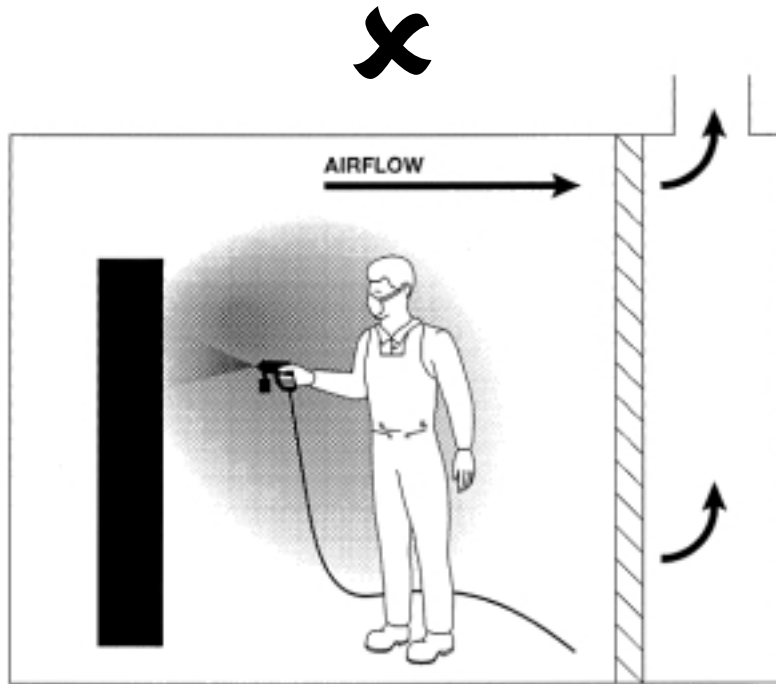


Figure 8(a)—The operator is exposed to overspray because of poor positioning in relation to the airflow

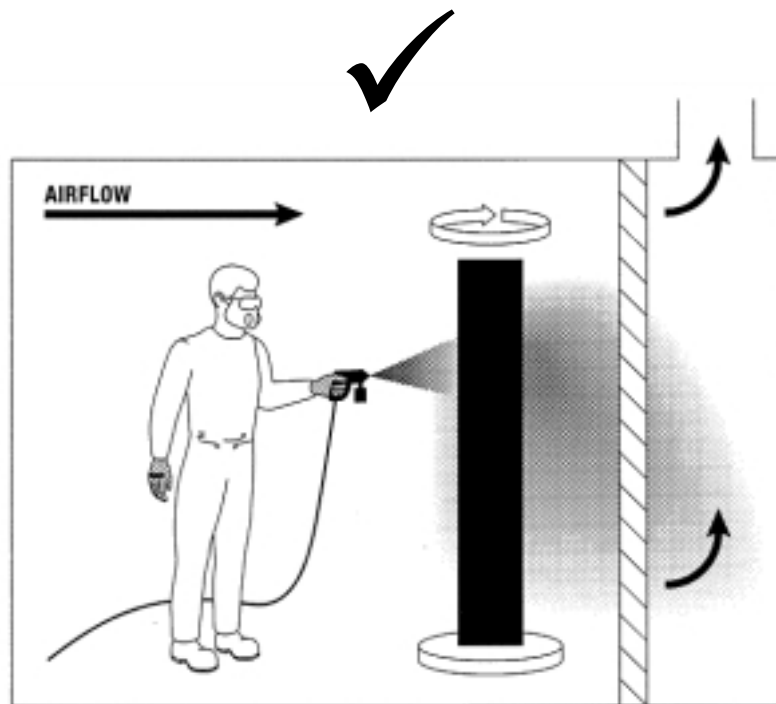


Figure 8(b)—To avoid overspray, the article should be rotated rather than the operator spraying against the airflow

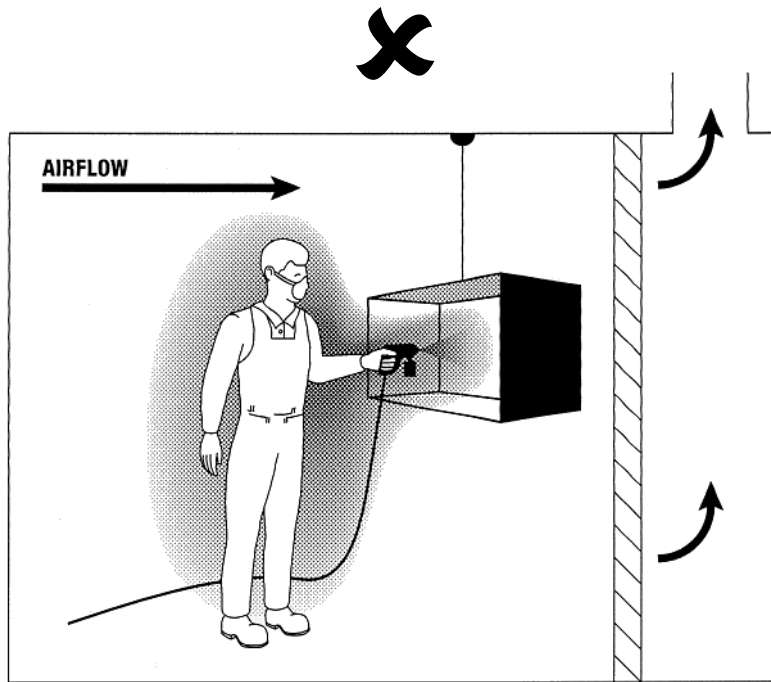


Figure 9(a)—*Spraying with a 'short' nozzle may cause overspray of the operator*

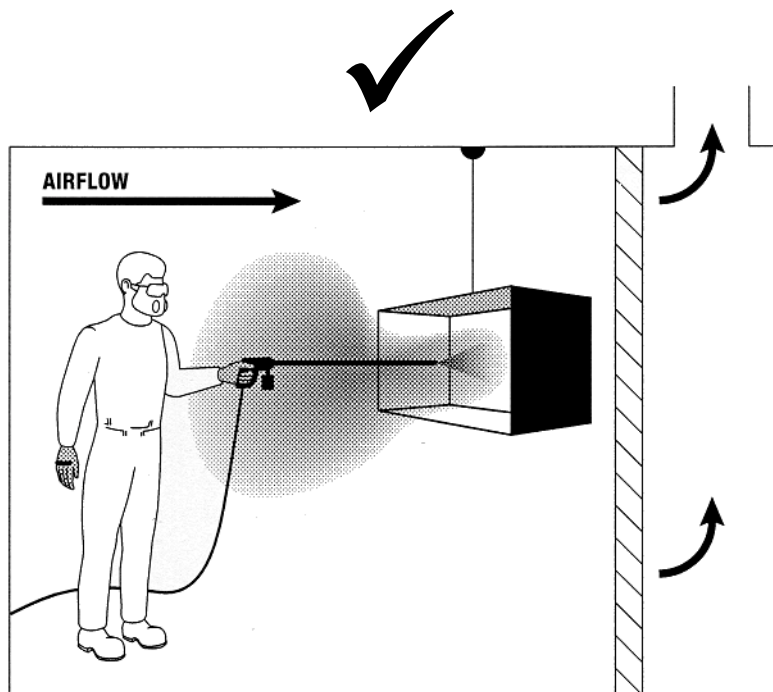


Figure 9(b)—*Spraying with a 'long' nozzle avoids overspray of the operator*

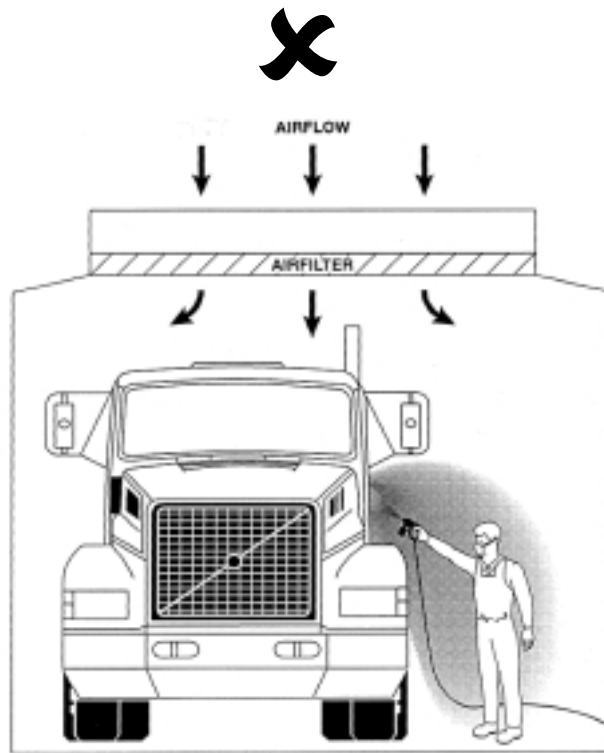


Figure 10(a)—*The operator is exposed to overspray, and stretching and reaching can cause discomfort and injury*

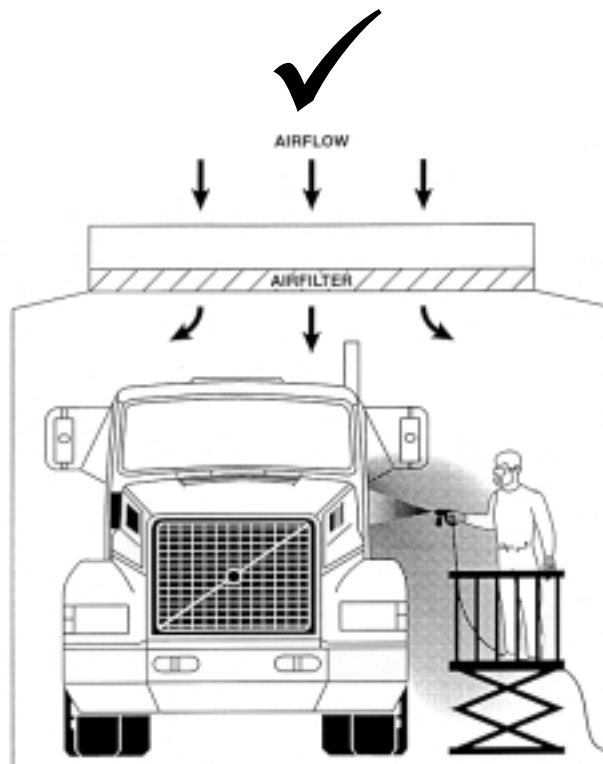


Figure 10(b)—*The use of a gantry or lift avoids overspray of the operator and problems caused by stretching and reaching*

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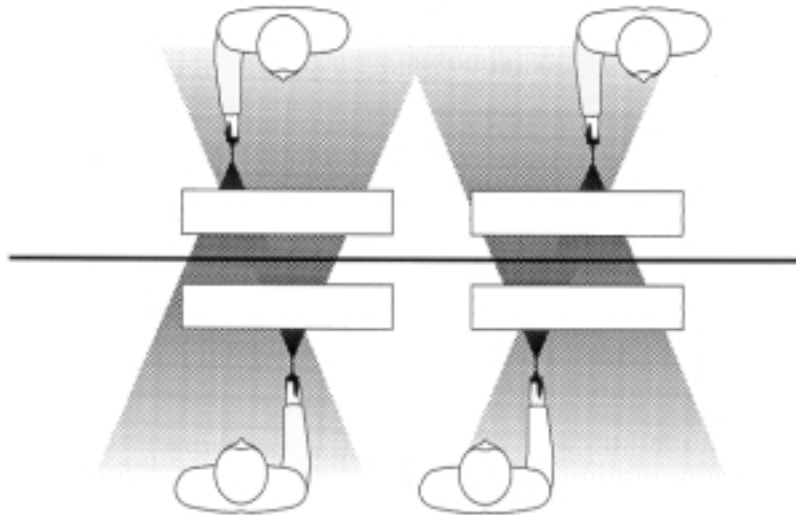


Figure 11(a)—Each operator is exposed to overspray because of their placement opposite each other

✓

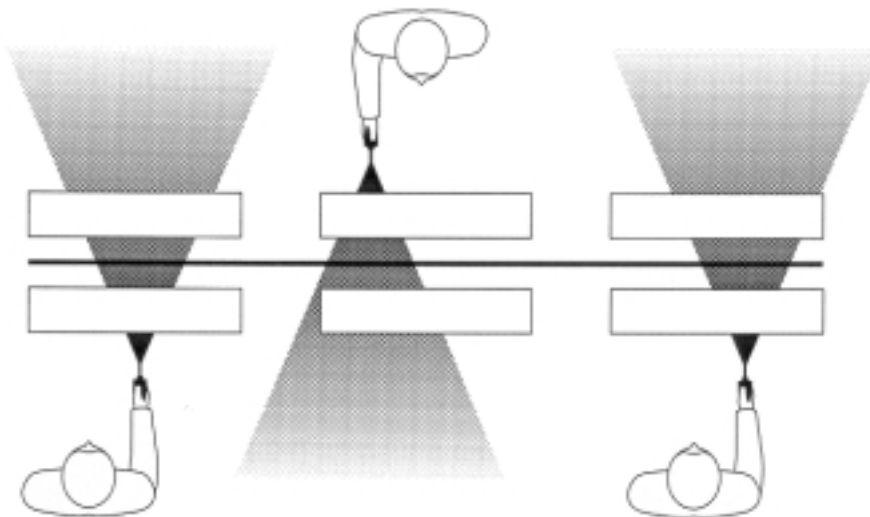


Figure 11(b)—The use of staggered work positions avoids overspray of the operators

- a) **Risk is, or could be, low and is unlikely to increase:**
- i) There is hardly any risk, for example, because the amounts of the substance used are too small to cause much harm, even if controls fail.
 - ii) The substance can cause minor effects, but its use is being strictly controlled in accordance with the MSDS (or equivalent information), and employees have been trained.
 - iii) The substance can cause minor effects, but its use can be readily controlled in accordance with the MSDS.
- b) **Risk is medium**—Although the substance is in Category 2 and there are a number of people who could be affected on a daily basis, use of the substance is strictly controlled in accordance with the MSDS and through effective engineering controls (6.21). No evidence of exposure has been found during the assessment.
- c) **Risk is high**—The potential harm is serious and the likelihood of exposure is high. For example, the substance is in Category 1; dusts, mists or fumes are visible in the air; there are widespread complaints of illness, discomfort and irritation; splashes are present; and employees have not been trained.
- d) **Risk is uncertain**—The level of exposure cannot be estimated with confidence, or there is not enough information available about a substance. Risk may also be uncertain when more complex processes and exposures are involved, for example, if there is potential exposure to a number of different substances.

Decision making about risk has to take into account possible variations in the risk level, for example, how high would the risk be if there was an emergency involving a particular substance?

Action arising from the assessment

5.25 Following the assessment, further decisions will be needed to:

- plan and implement appropriate control measures;
- ensure the control measures are properly used and maintained;
- arrange induction and training;
- determine if monitoring or health surveillance is required;
- review or develop appropriate first-aid and emergency procedures; and
- review or develop appropriate Standard Operating Procedures.

Simple and obvious assessments

5.26 If the risk is assessed as low, then the assessment is complete as soon as controls are implemented in accordance with the MSDS and employees are trained in use of the controls. For these simple and obvious assessments, the employer must ensure that completion of the assessment is recorded in the Hazardous Substances Register.

C Chapters 6–8; 5.34; 5.42.

C 5.44 - recording simple and obvious assessments.

C 4.20 - Hazardous Substances Registers.

Maintaining controls

5.27 If the risk is assessed as low, or medium, it is still important to make sure controls are maintained and that employees are trained in use of the controls. Control can deteriorate and this might not be apparent immediately. For example, plant could fail, control measures might not be used properly or there might be an increase in the amount of a substance used. See also 6.8—a longer term control program might aim to eventually reduce the medium level risks, for example, by using a less hazardous substance.

High risks and uncertain risks

5.28 If the risk is assessed as high, then control measures must be identified and implemented immediately. Consideration should be given to stopping the process until risk can be controlled. Monitoring and health surveillance may be required. A more detailed assessment may be needed. Longer term control requirements should be determined. A further assessment should be done when controls are in place.

5.29 If the risk is uncertain, then a more detailed assessment should be done. Interim control measures should be put in place, with the aim of reducing potential exposure as much as possible.

More detailed assessments

5.30 A more detailed assessment is needed if the risk level is uncertain. It may also be needed if the risk level is high.

5.31 A more detailed assessment could involve:

- obtaining more information about substances;
- a thorough evaluation of the work to determine exposures as accurately as possible (including monitoring and health surveillance, where appropriate); and
- examination or testing of existing control measures.

Generic assessments

5.32 The same hazardous substance/s may be used in a number of different workplaces, or work areas within the one workplace. If the circumstances of use are the same or similar, then a generic assessment may be appropriate. This means one assessment is done to cover the different workplaces or work areas involved. The individual employer is responsible for ensuring that the generic assessment is valid for those workplaces or work areas.

5.33 Generic assessments may be done where a single employer controls many similar workplaces, for example, several spray shops under the one management or by a trade association on behalf of a number of different employers with essentially identical workplaces.

C Chapter 7 -
Reviewing the
Control Measures;
Chapter 8 -
Induction and
Training.

C 5.30 - more
detailed
assessments;
Chapter 6 - Risk
Control.

Atmospheric monitoring

5.34 Atmospheric monitoring is the sampling of workplace atmospheres to obtain an estimate of inhalation exposure to hazardous substances. Monitoring indicates whether the recommended exposure standards are being exceeded or approached. Normally it is necessary for an occupational hygienist to do the monitoring.

5.35 Monitoring may be required:

- when there is uncertainty about the level of exposure;
- to help with the risk assessment process;
- to test the effectiveness of the control measures; and/or
- as a review measure.

5.36 The employer must arrange for monitoring if the assessment shows that it is necessary.

5.37 The procedures for monitoring should detail:

- when and how the monitoring is to be done;
- the sampling procedures and analytical methods to be used;
- the sites and frequency of sampling; and
- how the results are to be interpreted.

5.38 If monitoring shows that the level of contamination regularly approaches or exceeds the relevant exposure standard/s, then the control measures should be reassessed and adjustments made to ensure exposure is reduced as much as possible.

Records of atmospheric monitoring

5.39 The employer must ensure that the results of monitoring are recorded. The records must be kept for 30 years after the date of the monitoring. Records must be kept for so long because some diseases, for example, cancers, take a long time to become evident.

5.40 The results of monitoring can be recorded in any convenient way, but the records should be easy to understand and to access. If health surveillance is being carried out, then the records of monitoring should be in a form that allows them to be compared with the health surveillance records.

5.41 The results of monitoring must be given to employees who could be exposed to the hazardous substances involved, and the records should be accessible to employees, employee representatives and the relevant public authorities.

Health surveillance

5.42 Health surveillance means the periodic checking of employees' health. Health surveillance is an important tool in preventing adverse health effects from hazardous substances. It is used:

C 5.11 - exposure standards.

C Chapter 6 - Risk Control; Chapter 7 - Reviewing the Control Measures.



NOHSC:2007
(1994)

C Chapter 9 - Health Surveillance.

- to help with the risk assessment;
- to ensure risk control measures are working effectively; and
- as part of the review process.

5.43 Arranging for health surveillance is the employer's responsibility. Health surveillance is mandatory for some substances.

Recording hazardous substances assessment reports

5.44 Completion of simple and obvious assessments must be noted in the register. The note should state that the MSDS (or equivalent information) was reviewed, that control measures are in place, and the date.

5.45 Records for other assessments should reflect the detail of the assessment. They should contain sufficient information to show why decisions about risks were made.

5.46 Assessment records must be kept for at least five years. If monitoring or health surveillance results from the assessment, then the assessment records, together with the monitoring or health surveillance records, must be kept for 30 years.

5.47 Assessment records should be readily accessible to all employees who could be exposed to hazardous substances through spray painting work, to their representatives and to the relevant public authorities. (Health surveillance records are subject to medical confidentiality.)

PLANT ASSESSMENTS

5.48 Employers, in consultation with employees or employee representatives, must assess the risks of the plant hazards they identified. The risk assessment of spray painting plant must take into account:

- systems of work associated with plant;
- layout and condition of the work environment where the plant is used;
- capability, skill and experience of the person/s normally using the plant; and
- reasonably foreseeable abnormal conditions.

5.49 Factors to be considered include whether the plant is:

- suitable and safe for the job it is doing;
- operated in accordance with the manufacturer's instructions or safety documentation;
- in good condition and well maintained; and
- safely and suitably located.

C Chapter 7 -
*Reviewing the Control
Measures.*

OHS

C 5.26 - *simple and
obvious assessments.*

C Appendix 3
*contains examples of
hazardous
substances risk
assessments and a
sample risk
assessment
worksheet which
would be an
appropriate record.*



*NOHSC:1005 (1994);
NOHSC:2007 (1994)*



*NOHSC:1010
(1994)*

C 4.23 -
*identification of
hazards from spray
painting plant.*

Work skills issues

A skilled, trained spray painter knows how to select and use equipment to get the best finish with the least waste. More waste means more hazardous substances risk from vapours and aerosols. Factors to be considered include:

- the greater the spraying distance, the greater the overspray;
- increased air pressure creates more overspray;
- selection of spray nozzles so that atomisation is no finer than necessary; and
- selection of the spray painting process to fit the job requirements without unnecessary overspray, bounce and dropout.

5.50 Assessing the level of risk from identified plant hazards should include one or a combination of the following:

- a) Inspection of the plant and its components, including, for example, inspecting the filters in air lines of respirators, the filters in spray booths, and the lines and fittings of pressure equipment.
- b) Inspection of the environment in which the plant operates to determine whether this is increasing the risk. For example, diesel-driven compressors should not be used in confined spaces.
- c) Testing or technical evaluation, for example, testing compressor gauges, air flows and gas emissions.
- d) Discussion with, or information from, designers, manufacturers, suppliers, importers, employers, employees or any other relevant parties.
- e) An analysis of injury, ill health and near-miss data.
- f) An audit, that is, a full examination of all available information relevant to the health and safety of those people working with, or close to, the plant.

Information for audits

Information sources for a full audit would include the results of a)–e) above, as well as such things as training programs, communication procedures, operating and maintenance procedures, the results of air monitoring and health surveillance, task analyses, purchasing procedures and professional expertise.

5.51 Employers are legally obliged to register some items of plant. Employers should keep records of hazard identification, risk assessment and risk control for all items of plant.

5.52 Where multiple items of plant of the same design are installed and used under conditions that are the same (for all practical purposes), the risk assessment may be carried out on a representative sample. However, where risk may vary from operator to operator, a separate assessment of the risk to each operator should be carried out on each item of plant.

OHS

REVISION OF ASSESSMENTS

5.53 Hazardous substances assessments must be reviewed at least every five years, and it is also recommended that plant assessments are reviewed at least every five years. A total, new assessment may not be required, particularly if the operation and risk to employees are similar to that initially assessed.

5.54 Assessments should also be revised if:

- a) a process, plant or substance is altered or relocated;
- b) new health or safety information on a process, plant or substance becomes available;
- c) monitoring or health surveillance indicate inadequate exposure control;
- d) new or improved control measures become practicable; or
- e) a significant incident or accident occurs.

6. RISK CONTROL

6.1 Employers must prevent employee exposure to workplace hazards, either by eliminating the hazards or by controlling as far as possible the risks of each hazard.

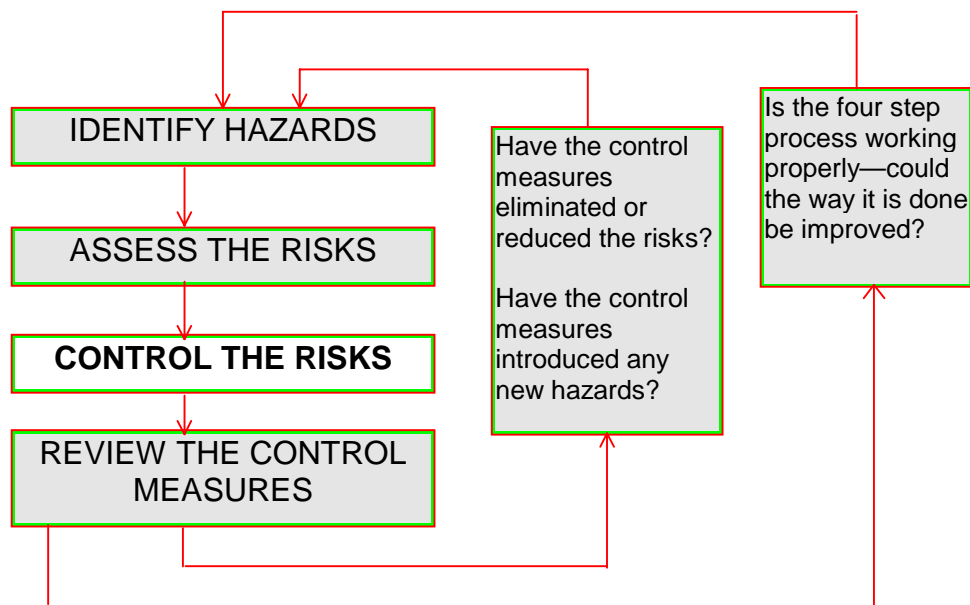


Figure 12—*Risk control is the third step in the four step process*

6.2 The risk assessment will have shown where risks are not being controlled, or not being controlled adequately. Information gathered during the assessment will help with the development of appropriate control measures. Control measures should be developed in consultation with employees or employee representatives.

6.3 The control measures should be considered as an integral part of the planning of any new workplace or modifications to an existing workplace. Control measures should not be treated as something that can be added at a later time.

6.4 Employees should use the control measures in the way the measures are intended.

HIERARCHY OF RISK CONTROL

6.5 This hierarchy lists the control measures that should be implemented, in priority order:

- 1) elimination of hazards;
- 2) substitution with safer alternatives;

- 3) isolation of the spray painting process;
- 4) engineering controls;
- 5) administrative controls; and
- 6) use of PPE.

6.6 Complete elimination of the hazards should be the first consideration. It is only if this is not practicable that consideration should be given to the second measure in the hierarchy—substitution. The third measure in the hierarchy should only be considered if the second measure is not practicable, and so on. PPE is a last resort and should be used only if higher level control measures are not practicable or are inadequate.

6.7 In some circumstances it is appropriate to use a combination of two or more control measures to ensure that risks are eliminated or reduced.

6.8 Longer term plans may be made to use control measures higher up in the hierarchy. For example, elimination of a particular substance may not be practicable now, but may become practicable in the future.

Hierarchy of Control Measure 1—Elimination

6.9 Elimination can be achieved by, for example, removing an item of plant that was assessed as a risk, ceasing to use particular hazardous substances or discontinuing the spray painting process.

6.10 Where it is essential to coat the surface, there may be other application methods, such as rollers, brushes or dipping, that can be used which will eliminate the need for spray painting.

6.11 Some hazardous substances are prohibited for certain uses. Some other hazardous substances that are carcinogenic (cancer-causing) are prohibited for most uses, or their use requires notification to the relevant authority.

Hierarchy of Control Measure 2—Substitution

6.12 Substitution means using a less hazardous substance, plant or process to do the same job.

6.13 Substitution measures include:

- a) replacing a hazardous substance with a less hazardous one, for example, using a Category 2 substance rather than a Category 1 substance;

OHS

C 5.20;
*Appendix 2 -
Hazard
Categories of
Spray Painting
Substances.*

- b) replacing a hazardous item of plant with a less hazardous one, for example, using a pneumatic sander rather than an electrical one; and
- c) using the same substance in a less hazardous process, for example, using HVLP spraying rather than airless spraying.

Hierarchy of Control Measure 3—Isolation

6.14 Isolation is separation of people from the hazard by physical barriers, distance or time. (Isolation by time means a delay mechanism is used, for instance, restricting re-entry to an area until fumes have dissipated.) There are three main methods of isolation that are particularly relevant to spray painting. In order of effectiveness, these are:

- a) automation of the process;
- b) use of a spray zone while spray painting inside a booth; or
- c) use of a spray zone while spray painting outside a booth.

Isolation—Automation of the process

6.15 The spray painting process can be isolated totally by automation. This is the most effective form of isolation because the process is fully contained and everyone is isolated from the hazards.

Isolation—Spray zone inside and around a spray booth

6.16 Spray booths are an effective form of containment. This type of isolation is the second most effective because people other than the spray painter are isolated from the hazard. Also, the spray painter has some protection as the spray booth is a form of engineering control.

Isolation—Spray zone where a spray booth is not used

6.17 Where a spray booth is not used, a spray zone, with restrictions on entry, can be designated around the area where spray painting is carried out. This form of isolation is the **least effective** because it does not provide protection to the spray painter and other forms of control should be used as well. It does, however, isolate other people from the hazard.

Isolation—Designating a spray zone

6.18 In determining the size of a spray zone and the time before re-entry is allowed, the following factors need to be considered:

- a) the nature of the substances being sprayed;
- b) the workplace environment, including wind speed, ambient temperature and humidity; and
- c) the location of other people.

C 6.21 -
engineering
controls.

Recommendations for spray zones when using different substance categories under different ventilation conditions can be found in Appendix 6.

C Appendix 6 - gives spray zones.

6.19 Changing, washing and eating areas should be separated from the spray zone to reduce exposure to hazardous substances, control the risk of cross-contamination and protect others.

Isolation—Controls for spray zones

6.20 Once a spray zone has been established, a number of procedures can be used to control risks. These include:

- a) Physical barriers to prevent unprotected persons from entering the spray zone.
- b) Restricted entry of unprotected persons into the spray zone for a time period that ensures airborne concentrations of hazardous substances have reduced below the exposure standards. The time required can be precisely determined during the risk assessment through monitoring in the workplace.
- c) Removal of hazardous substances that are not immediately needed for spray painting work to reduce unnecessary exposure and fire or explosion risks.
- d) Removal of stored wastes, such as solvent-soaked rags and waste paint, from within the spray zone to control fire or explosion risks.
- e) Removal of electrical and ignition sources from within the spray zone to control fire or explosion risks.

C The tables in Appendix 6 give recommended times.

AS 2430.1;
2430.3

Sources of ignition

At a minimum, the following sources of ignition should be considered before spraying commences:

- lit cigarettes, pipes and cigars;
- equipment that produces sparks, such as abrasive grinding wheels;
- electrical sparks and arcs generated by the discharge of static electricity from poorly earthed equipment;
- electrical short circuits;
- burner flames, welding or cutting torches, matches, cigarette lighters, heaters or burning material;
- hot surfaces such as operating internal combustion engines, frictional sparks, heated wires, glowing metals, overheated bearings and broken electric light bulbs which expose the hot filament;
- catalytic reactions, for example, a catalyst speeds the resin hardening process when two pack epoxy paints are mixed, and this creates heat;
- self-heating or spontaneous combustion; and
- portable electrical equipment, including mobile phones.

If electrical equipment or installations are necessary in spray painting and paint mixing areas, then they should comply with AS 2381.1, as required by the National Wiring Rules (AS 3000).

AS 2381.1;
3000.

- f) Placement of warning signs stating that unauthorised entry is prohibited, and the restrictions that apply within the spray zone. An example of a warning sign is ‘SPRAY ZONE: UNAUTHORISED PEOPLE KEEP OUT. NO SMOKING, WELDING, GRINDING, NAKED FLAMES OR OTHER SOURCES OF IGNITION’.
- g) Warning signs should be posted in accordance with AS 1319.

AS 1319

Hierarchy of Control Measure 4—Engineering controls

6.21 Engineering controls involve the use of engineering principles to reduce risk. Engineering controls for spray painting include:

C 6.23–6.35;
6.36–6.38;
6.39–6.40;
6.41

- ventilation;
- electrical safety;
- location and design of high pressure hoses and lines; and
- ergonomic design.

6.22 Engineering controls can minimise the generation of hazardous spray painting substances, suppress or contain hazardous spray painting substances and limit the area of contamination in the event of spills and leaks.

Engineering controls—Ventilation

6.23 Ventilation helps to control the risks from vapours and aerosols created during spray painting. It is the primary means of preventing inhalation of hazardous substances. It is also an important means to reduce skin or eye contact with hazardous substances, and to control fire or explosion hazards. Employers should ensure that ventilation is well designed and properly maintained so that exposure to hazardous substances is minimised and the fire risk is properly controlled.

6.24 Guidance from persons competent in the design of ventilation systems should be sought prior to the selection of a ventilation system.

6.25 For spray painting, the types of ventilation in descending order of utility and effectiveness are:

- a) a down-draught spray booth;
- b) a semi down-draught spray booth;
- c) an open spray booth;
- d) local exhaust ventilation; and
- e) dilution ventilation.



Conclusions about spray booth effectiveness are based on research undertaken by W.A. Heitbrink et al.

Ventilation—Spray booths

6.26 The most effective form of ventilation for spray painting is the spray booth. Spray painting should always be carried out in a spray booth if possible.

6.27 Spray booths contain an exhaust ventilation system. Ventilation and exhaust system requirements affect the design, construction, location and installation of spray booths. Therefore, persons experienced in the fields of spray booth and ventilation design should be consulted about the choice of booth. Spray booths should comply with AS/NZS 4114 and spray booth construction should meet individual local State or Territory legislative requirements.

AS AS/NZS 4114

Ventilation—Local exhaust ventilation

6.28 Exhaust ventilation is a mechanical system for the removal of atmospheric contaminants. Local exhaust ventilation systems are normally used for contaminant control during spray painting activities, capturing the overspray and solvent vapour as close to the source of release as possible. Local exhaust ventilation systems should be fitted with a particulate filtration system to filter overspray.

6.29 Local exhaust ventilation captures the overspray and solvent vapour by drawing the contaminants into a capture hood. There are different designs of capture hoods and some are more effective than others. Advice on selection should be sought, for instance, from the local OHS authority. Information on local exhaust ventilation design for hazardous areas can be found in AS 1482. This includes information on:

OHS
AS 1482

- elements of extraction systems;
- hood design;
- capture velocities and air volume exhausted; and
- electrical safety requirements.

6.30 Local exhaust ventilation should be used for indoor spray painting when a spray booth cannot be used. For example, when the spray painting work involves internal building structures or the object is too large.

6.31 Local exhaust ventilation, in combination with other control measures such as isolation, should be used for external spray painting with Category 1 substances when a spray booth cannot be used. For example, when the spray painting work involves an external structure or an object too large.

Ventilation—Dilution ventilation

6.32 Dilution ventilation is the dilution and displacement of contaminated air by fresh air. The fresh air is supplied to the work area by mechanical supply fans or natural air currents through doors, windows or other openings in the building. The contaminated air is forced out through relief openings or drawn out by an exhaust fan.

6.33 Dilution ventilation can be used to supplement local exhaust ventilation if the local exhaust ventilation is not fully effective. Using both types of ventilation together may provide an acceptable method for controlling the fire and hazardous substances risks of spray painting vapours and aerosols, when the use of a spray booth is not practical. However, other controls, such as isolation and administrative controls, will be needed to ensure exposure standards are not exceeded.

C 6.14 - isolation;
6.42 - administrative controls.

6.34 The following practices for the design and operation of dilution ventilation systems should be adopted:

- a) locate the exhaust openings as close as possible to the spray painting operation;
- b) locate the exhaust openings and the inlet air supply so that the incoming air supply passes through the spray zone;
- c) the spray painting operator should remain between the air inlet supply and the source of vapours or aerosols generated during the spray painting operation;
- d) direct dilution ventilation through the spray zone may require temporary barriers to induce channelling of the dilution ventilation and to restrict cross currents;
- e) ensure that contaminated exhaust air does not re-enter the work area (exhaust air should be exhausted above the roof line where possible and away from open windows, external air intakes or other building openings);
- f) make use of auxiliary mixing fans to disperse the spray painting emissions towards the outlet and to enhance the rate of air dilution; and
- g) dilution ventilation systems should comply with AS 1482.

AS 1482

Working in confined spaces

6.35 All work in confined spaces should be carried out in accordance with AS 2865/NOHSC:1009 (1994). Key requirements include:

C Chapter 10 for a definition of confined spaces.

AS 2865/



NOHSC:1009
(1994)

- a) the use of atmospheric monitoring;
- b) the presence of a trained standby observer;
- c) the use of safety harnesses; and
- d) rescue equipment.

Engineering controls—Electrical safety

6.36 Airless spray painting using high fluid pressures can produce static electricity. This may cause a spark. Therefore, the airless spray gun and any conductive article that is being sprayed, including containers into which the flow from the gun is directed, and the operator, should be electrically earthed.

6.37 Static electricity can be generated by:

- clothing or synthetic fibres prone to accumulation of static charge, including nylon, pure wool and wool blends (unless treated), and non-conducting footwear;
- liquid flowing in pipes or vessels; and
- during blending, mixing and decanting from vessels.

Methods of bonding, dissipating charge from installations, and electrical isolation to prevent static discharge can be referenced in AS 1020.

6.38 The National Wiring Rules (AS 3000) require that all electrical equipment located in a hazard zone comply with AS 2381.1. AS 2381.1 provides guidance on the selection, installation and maintenance of electrical equipment for use in hazard zones, including areas where flammable materials are generated, processed, handled and stored.

Engineering controls—Location and design of high pressure hoses and lines

6.39 Employers should ensure that hoses and lines are located so that:

- they are protected from a leak or rupture; and
- in the event of a leak or rupture, flammable material is not discharged into an area where there is a source of ignition.

6.40 Hoses should be the minimum length required to reach safely from the source to the outlet.

Engineering controls—Ergonomic design

6.41 The health and safety of the work environment can be improved by ergonomic modifications. The design of the workplace, including the location and design of fixtures, fittings and equipment, should be considered. For example, if walls and work surfaces are as smooth as possible, it will be easier to keep them free of combustible residues. Improving the storage facilities will enable substances to be stored safely. Installing better lighting will reduce the likelihood of mishaps.

Hierarchy of Control Measure 5—Administrative controls

6.42 Administrative controls are measures to organise work so that it is safer. Employers should ensure that work practices and procedures that minimise risk are incorporated into management systems.

6.43 Administrative controls can be applied to the following:

- paint and surface preparation;
- mixing and pouring;

AS 1020

AS 3000;
2381.1

A hazard zone is an area with a potentially explosive atmosphere. The definition of a hazard zone overlaps with, but is not the same as, that of a spray zone - see Chapter 10.

- storage and handling;
- spray painting and curing operations;
- maintenance and cleaning;
- emergency procedures; and
- hygiene

Administrative controls—Paint and surface preparation

6.44 Hazardous dusts can be generated by surface preparation, as the surfaces to be prepared are often coated in materials that contain hazardous substances, such as lead, carbon fibres or fibreglass. The dusts that are created by preparing such surfaces also contain the hazardous substances, and can be inhaled by employees. Administrative controls to minimise the risks from this hazard include:

- a) where sanding is required to prepare a surface, wet rubbing can be used; and
- b) dry sanding should be avoided unless dust extraction equipment is used.

6.45 Surfaces should not be cleaned with rust/corrosion treatments unless there is adequate ventilation, as the treatments are an inhalation hazard.

6.46 To avoid manual handling injury, work should be arranged to minimise continual or prolonged stooping or bending by employees during surface preparation.

Administrative controls—Mixing and pouring

6.47 Employers should ensure good ventilation and total absence of ignition sources in paint mixing and tinting areas, which should be clearly designated and retained exclusively for that purpose.

6.48 Before pouring flammable liquids from one container into another, both containers should initially be set down on an earthed surface and preferably connected together, to prevent electrostatic sparks igniting the vapour. The container from which the liquid is to be poured should then be lifted, its edge or lip brought into contact with the empty container before pouring, and the two kept in contact while pouring.

C *box at*
6.20; 6.38

AS 3000;
2381.1;
1020

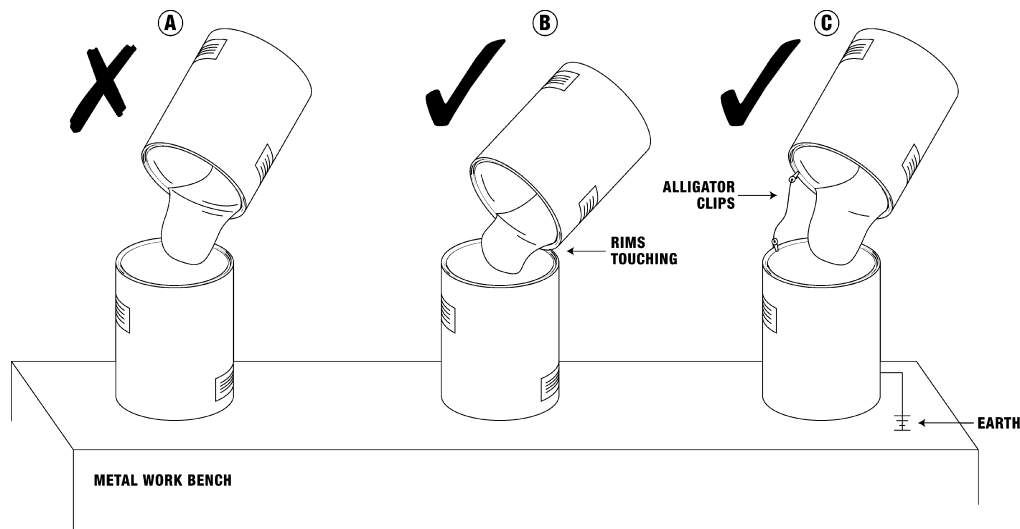


Figure 13—Pouring flammable liquids from one container into another

6.49 Air displaced from a container being filled could be saturated with vapour leading to the formation of pockets of explosive mixtures (and/or inhalation hazards). Where containers have air lines, the plugs should be replaced immediately the air lines are disconnected.

6.50 Unused or surplus liquid should always be returned to a labelled container designated for that liquid. The unnecessary or accidental mixing of different liquids should be avoided. For example, a small amount of acetone accidentally mixed with kerosene could increase the fire risk if the mixture is later treated as kerosene.

6.51 Empty drums or cans may still contain vapour that could explode under certain circumstances. They should therefore be closed and removed to a safe place while awaiting disposal in accordance with local regulations.

Administrative controls—Storage and handling

6.52 These controls relate to the safe storage and handling of the quantities usually required in spray painting. They do not relate to bulk storage, which should be in accordance with relevant State, Territory or Commonwealth dangerous goods legislation. All storage and handling of flammable or combustible liquids should be in accordance with AS 1940.

6.53 Administrative controls for storage and handling include making sure:

- a) supplies of flammable materials are stored in tightly closed containers and correctly labelled;
- b) lids of containers are replaced after each use;

C 4.3 – 4.8 - labels.

OHS

AS 1940

C 4.3–4.8 - labels.

- c) only material actually in use may be in the spray zone, and no more than one day's supply of materials is kept in readiness outside the spray zone. All other supplies of paints and solvents should be kept in a separate store room or storage cabinet;
- d) all flammable liquids are stored in closed airtight metal containers when not actually in use, and such containers are clearly labelled to show the nature of their contents;
- e) containers of flammable liquid are not left in direct sunlight or near any heat source or source of ignition;
- f) small containers should be stored in flammable storage cabinets that comply with AS 1940;
- g) warning signs are placed on storage cabinets and outside storage areas to draw attention to the hazardous nature of the stored material;
- h) open containers are not used for storage. Where spray guns are gravity fed, containers should not exceed 45 litres in capacity and should be suspended firmly by non-combustible material;
- i) paint and solvent spills should be cleaned up quickly; and
- j) paint or solvent saturated cleaning rags, or other cotton waste that could spontaneously burst into flames, are wet immediately after use and safely contained until they can be disposed of in accordance with local regulations, for example, in a lidded 'wet bin' with water.

AS 1940

Tips for preventing solvent evaporation

Close-fitting drum covers with internal agitators and access doors are much more effective in preventing solvent evaporation than 'clamp-on' agitators, loose fitting lids and open doors.

Safety cans can be used below solvent spigots to catch dripping and lessen the subsequent evaporation.

Administrative controls—Spray painting operations

6.54 The operator should avoid being positioned between the object and the exhaust. If an object needs to be sprayed on all sides, this can be done by:

- rotating the object on a turntable or revolving hook;
- using in-line spray booths; or
- using down-draught booths.

6.55 When using down-draught booths, spraying should not be carried out above head height, as contaminants are carried downwards by the air flow. When spraying a high-sided vehicle or other tall objects in a down-draught booth, a platform suitable for use in explosive atmospheres, preferably a powered lift platform, should be used. This will not only make the surface more accessible but will also ensure that the proper orientation with respect to

C See Figures 8–11 at 5.24.

airflow is maintained. The spray should never be directed above head height—for underbody spraying of vehicles or aircraft this may require the use of extension poles or ramps.

6.56 Unnecessary equipment should be kept out of booths, especially in the case of open fronted booths. Large items of equipment, such as paint drums, can cause recirculation of contaminated air into the employee’s breathing zone.

6.57 Proper care should be taken with the handling and use of pressurised equipment.

Administrative controls—Maintenance and cleaning

6.58 Hoses and lines conveying flammable liquids should be regularly inspected and maintained.

6.59 All spray painting plant should be regularly cleaned and maintained in accordance with the manufacturer’s instructions. This safeguards employees’ health, minimises fire hazards and ensures optimum performance from the equipment.

6.60 Spray booths should be inspected and maintained in accordance with AS/NZS 4114. If the spray booth is not regularly maintained, and properly cleaned, it will become ineffective at removing contaminated air. This will greatly increase hazardous substances risk.

6.61 Cleaning operations should be performed with the local exhaust ventilation operating.

For example, the life of respirators can be shortened by failure to store them in airtight containers away from work areas.

AS AS/NZS 4114

<p><i>Minimum cleaning schedule for spray booths and associated equipment</i></p> <p>Daily</p> <ul style="list-style-type: none">• clean the spray area, especially the floor and work benches, and make sure equipment and spray materials are stored correctly at the end of each work shift. <p>Weekly</p> <ul style="list-style-type: none">• clean all surfaces that are subject to overspray to prevent build-up of dried overspray which is a fire hazard; and• inspect all fans and ducts in booths where air is filtered by being passed through an arrangement of metal baffles and clean as necessary to prevent build-up of dried overspray. <p>Monthly</p> <ul style="list-style-type: none">• inspect all fans and ducts in booths protected by filters or air washing devices and clean as necessary; and• inspect all high pressure hoses. <p>Quarterly</p> <ul style="list-style-type: none">• clean all fans and ducts.

6.62 Airless spray guns should be cleaned in accordance with manufacturer's instructions. They should not be cleaned by covering the nozzle with a cloth or other material held in the hand, as this method can result in paint injection injuries.

6.63 Any areas subject to the build up of combustible residues, including walls, floors and work surfaces, should be cleaned frequently. Dusts generated by sanding or grinding should be removed using water wetted rags, wet vacuum cleaners or other wetted cleaning equipment. (Dusts should not be swept unless the exhaust ventilation is on.) The workplace generally should be kept clean and tidy so that additional hazards are not created, for example, slip or trip hazards. Facilities for washing and changing and meal areas should be located away from hazards and well maintained.

Administrative controls—Emergency procedures

6.64 Even with all practicable control measures in place, an emergency situation could still occur. For example, there could be a leak, spill or uncontrolled release of a hazardous substance. Emergency procedures should be established, including:

- a) access to sufficient PPE for the person/s assigned to identify the source of the release and do repairs;
- b) exclusion of all persons not concerned with the emergency from the contaminated area; and
- c) safe disposal of the substance.

Emergency procedures should be documented and copies strategically located throughout the workplace so as to be clearly visible at all times. All personnel need to be trained in accordance with the emergency procedures.

6.65 The labels and MSDS of all hazardous substances in the workplace should be referred to for information when planning emergency procedures.

6.66 Information on emergency stops/guards for plant should be displayed so that it can easily be observed by anyone who could be affected by the plant's operation.

Administrative controls—Hygiene

6.67 If hazardous substances are splashed onto clothing or the body, the contaminated clothing should be removed immediately and the skin thoroughly cleansed with water, or with water and a water-based cleanser.

6.68 Most organic solvents and thinners can be absorbed through the skin into the body and should not be used to clean the skin.

**C 6.71 -
personal
protective
equipment.**

6.69 Contaminated clothing should be laundered before re-use.

6.70 Hand washing facilities should be readily available. Before eating, drinking or smoking, and at the end of the day's work, employees should remove any PPE used and wash their hands and face.

Hierarchy of Control Measure 6—Personal Protective Equipment

6.71 PPE provides a barrier to protect limbs, skin, eyes, the respiratory system and other body parts from exposure to hazards.

6.72 PPE is a last resort, because it does not control risks 'at source'. PPE should be used in conjunction with the higher order control measures, and should not be relied upon as the only control measure.

6.73 Where PPE is used, employers should ensure that it is:

- a) suitable for the person using it, the tasks they are doing, the category of substances being used and the level of risk;
- b) readily available, clean and functional;
- c) supplied to each individual, that is, everyone is given his or her own PPE;
- d) properly fitted to give adequate protection;
- e) correctly used and regularly maintained in accordance with the manufacturer's instructions; and

Maintenance of PPE

If PPE is not maintained in accordance with the manufacturer's instructions, it will not function properly. For example, if filters on the air line of air-supplied respirators are not regularly checked and replaced or cleaned as appropriate, the operator's air supply can become contaminated with oil and water from the generator.

- f) accompanied by training in all aspects of PPE prior to use.

PPE training

Training should include:

- the hazard;
- possible results of exposure;
- measures being taken to eliminate the hazard and/or reduce the risk;
- how the PPE works;
- how and when to use the PPE;
- correct fitting of the PPE;
- how to test the PPE is working;
- how and when to clean and maintain PPE;
- when to repair and replace the PPE;
- safe storage; and
- health surveillance.

C Appendix 7 -
*Personal
Protective
Equipment
Required under
Different
Ventilation
Conditions.*

6.74 Employees should wear, store and maintain the PPE in accordance with their training.

6.75 When choosing PPE and planning work processes involving PPE, consideration should be given to controlling any risks that could be caused by the PPE. For example:

- a) Choose air-supplied respirators that are not cumbersome so that the air lines do not easily become tangled or caught on other objects. This prevents the PPE from becoming a manual handling hazard.
- b) Choose air-supplied respirators that generate less air noise so that the operators can hear warning signals. For example, choose those with hoods rather than the laminar full-face type.
- c) Where a job requires individuals to wear PPE for a sustained period, rest breaks should be scheduled and taken. The exact length and frequency of such breaks will depend on the nature of the spray painting tasks and the work environment. The breaks will prevent physiological burdens being imposed on employees, such as discomfort or stress due to heat.

6.76 The recommendations in Appendix 7 also apply to all persons, other than the spray painter, who enter the spray zone.

6.77 When PPE is used, to ensure that the hazard being protected against is addressed, regular reviews are necessary. This is to see if it is now more feasible to use a higher order control. In particular, knowledge about reducing the risk of exposure to the hazard, and the PPE available, should be reviewed.

C 6.18 -
*designating a
spray zone;
Appendix 7 -
Personal
Protective
Equipment
Required under
Different
Ventilation
Conditions.*

C Chapter 7 -
*Reviewing the
Control Measures*

7. REVIEWING THE CONTROL MEASURES

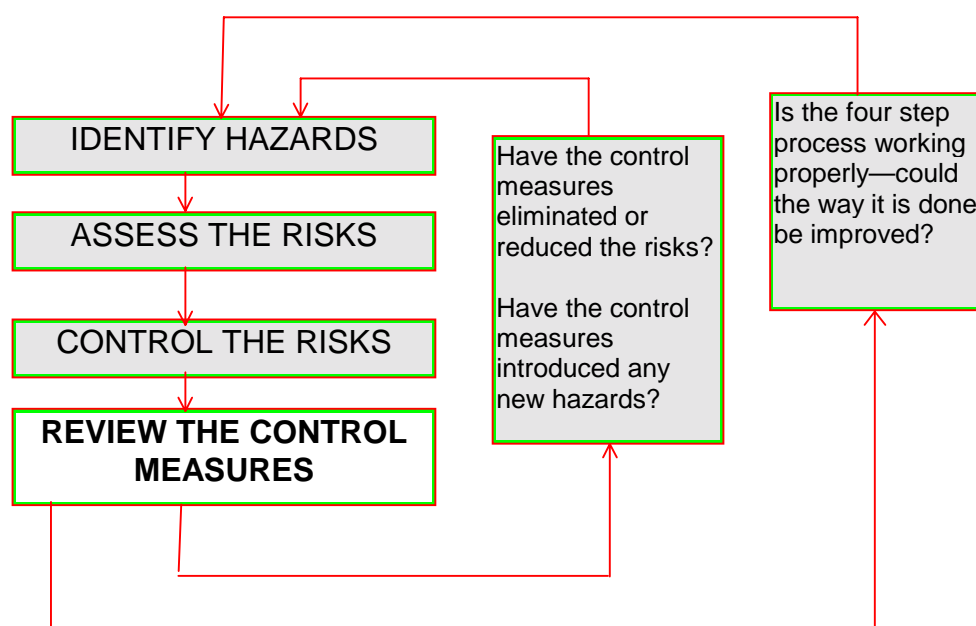


Figure 14—Review is the fourth step in the four step process

7.1 The control measures must be reviewed to ensure that they are working effectively and to find out where they could be improved. This includes review of:

- a) the four step process itself; and
- b) the risk control measures being used.

7.2 Employers, in consultation with employees, should examine all steps of the **four step process** to determine where and how it could be improved. For example, were all hazards identified? If not, why was this? Were risk levels accurately assessed? Could risk assessments be done more effectively? Is there a better way to make decisions about control measures? Is the review process providing useful information?

7.3 The **risk control measures** should be properly maintained and regularly reviewed. Opportunities to eliminate hazards should be sought. Less hazardous substances, plant and processes should be substituted for more hazardous ones whenever possible. Isolation measures should be evaluated to ensure that they are protecting employees from exposure. Engineering controls should be thoroughly examined and tested at intervals as recommended by the manufacturer or as specified in the relevant Australian Standards. Administrative controls should be checked to make sure that they are being followed. The use of PPE should be reviewed as described at 6.77.

Internal or external auditing can be used to check performance and identify aspects that need to be improved.

The results of monitoring and health surveillance provide useful information for reviews.

C Chapter 6 - Risk Control.

7.4 Procedures should be established for servicing those control measures that require it. The procedures should include the frequency of servicing, who is responsible, how any defects will be corrected, performance testing and evaluation standards, and records of servicing.

7.5 Employers should also check that implementation of the control measures has not created further hazards.

7.6 Employees should report promptly to their employer or supervisor any defects that they notice in control measures, equipment, machinery, facilities or labelling.

7.7 Long term plans can be made to improve health and safety by gradually incorporating preventive measures into management systems, and by planning to use higher order controls. For example, employers might aim to introduce a 'buy safe' policy, timetable the substitution of major hazards with less hazardous alternatives, upgrade training programs and improve workplace communication.

*C 3.21 -
management
systems;
6.5 - control
hierarchy.*

8. INDUCTION AND TRAINING

8.1 Employers must provide employees with health and safety training, including induction training for new employees.

8.2 Training should enable employees to apply health and safety information on the job, and participate in decision making about health and safety.

8.3 Training should be an ongoing process so that employees learn about new developments, and their knowledge and skills continue to improve. Refresher training is useful and should be provided, especially to employees returning from extended leave or returning to a work process after an extended period of absence.

8.4 When employees undertake new jobs or new tasks, they should be trained before starting.

8.5 Training supplements other preventive measures described in this national guidance material and is not sufficient in itself to reduce health and safety risks.

TARGET GROUPS REQUIRING TRAINING

8.6 In relation to hazardous substances and plant, induction and training should be provided to:

- employees whose work could expose them to hazardous substances, including employees who are preparing surfaces, mixing the substances and spraying or otherwise applying the substances;
- employees who use plant, or could be exposed to risk from plant, where plant includes, but is not limited to, spray booths, spray guns, ventilation systems, pumps, hoses, paint mixers, pressure pots and bake ovens;
- new employees prior to their using hazardous substances or plant;
- supervisors of all the above employees;
- those who purchase hazardous substances or plant;
- those who select, implement, use and maintain control measures for hazardous substances and plant;
- health and safety representatives; and
- those who have direct involvement in fire or emergency action.

ELEMENTS OF A TRAINING PROGRAM

8.7 The content of training and the amount of training needed depends on:

- the nature of the hazards;
- the complexity of the work procedures and risk control measures; and
- the duties of individual employees.



*NOHSC:1005
(1994);
NOHSC:2007
(1994);
NOHSC:1010
(1994)*

8.8 Risk assessment is an important guide to the training required. More detailed training is needed when the risk is higher.

8.9 Induction and all other training should include the following elements, as relevant:

- a) Information about hazardous substances that employees could be exposed to. This should cover the nature of the hazards, risks to health, exposure standards and routes of entry of the hazardous substances into the body.
- b) The nature of the hazards from workplace plant and systems of work associated with the plant, and the availability and use of information about the plant.
- c) The correct labelling of substances, the information that each part of the label provides and why the information is being provided.
- d) The availability of MSDS or equivalent information on substances, how to access the MSDS and the information that each part of the MSDS provides.
- e) The four step process for risk control and how employees can contribute.
- f) The measures used to control exposure to hazardous substances and risks from plant, including any information that employees need for the correct use and maintenance of control measures.
- g) The procedures to be followed in case of an emergency involving hazardous substances or plant, including any special decontamination procedures.
- h) First aid and incident reporting procedures to be followed in case of injury, illness or unplanned event with hazardous potential.
- i) The nature of, and reasons for, any atmospheric monitoring required, and access to results of monitoring.
- j) The nature of, and reasons for, any health surveillance required, and employees' rights and obligations in relation to health surveillance.
- k) Employees' right to be consulted, and to be advised of any planned changes that might affect health and safety, for example, the introduction of new substances or new work processes.

C Chapters 3–7.

C See 6.73 f) and the box following it for PPE training.

- l) Relevant duties of suppliers, employers and employees under regulations for hazardous substances and plant.
- m) The provisions of this national guidance material.

TRAINING METHODS

8.10 Training should be designed to draw on and build on employees' current knowledge and previous experience.

8.11 Training should be practical and, where relevant, include hands-on sessions, for example, on correctly setting up a spray zone, and on routine and emergency procedures. Trainers should have the necessary skills, knowledge and experience to provide the training.

8.12 Language and literacy factors should be taken into account in determining the most suitable training methods. If the literacy level is low, then verbal methods or visual methods should be used. If the employees are of a non-English speaking background, then training should be provided in the languages used by the employees in the workplace.

REVIEW OF TRAINING

8.13 Training should be reviewed to make sure that employees are gaining the skills and knowledge they need. Generally, employees should be able to demonstrate their skills.

8.14 Employers should review their induction, refresher and other training programs regularly (about once a year), and whenever there is a change in the hazard information available, the work practices or risk control measures.

RECORDS OF TRAINING

8.15 Employers must keep the following records:

- a) the names of employees receiving training, and the dates of attendance;
- b) an outline of the course content; and
- c) the names and credentials of persons providing the training.

8.16 These records should be kept for five years after the training takes place, and for longer if the persons trained are still employed at the same workplace or by the same employer. Records of training should be readily accessible to employees.

8.17 Records should also be kept which include the results of training evaluation or feedback.

9. HEALTH SURVEILLANCE

9.1 Health surveillance is the periodic checking of the health of employees who may be exposed to hazardous substances at work.

9.2 Health surveillance is mandatory if the risk assessment shows employees are being exposed to hazardous substances and:

- a) there is a significant risk to their health from any substance scheduled under State, Territory or Commonwealth regulations, for example, isocyanates; or
- b) it is reasonably likely that they may suffer an identifiable disease or health effect due to the conditions of their work, and there are proper techniques to detect indications of that disease or health effect; or
- c) a valid biological monitoring procedure is available (see 9.3a)) to detect traces of substance/s in their bodies, and it is reasonably likely that the results will diverge from the normal range.

TYPES OF HEALTH SURVEILLANCE

9.3 Several different procedures may be needed to monitor employees' health properly. These include:

- a) **Biological monitoring**—This is done by measurement and assessment of the amount of a hazardous substance (or its metabolite) in the employee's blood, urine or exhaled breath. For example, biological monitoring for lead measures the amount of lead that employees have in their bodies as a result of spray painting exposures, by analysing a small sample of their blood. Biological monitoring tests are not available for all hazardous substances.
- b) **Medical tests**—These are tests for specific health effects that may be the result of spray painting exposures. For example, respiratory function tests that test how well the lungs are functioning can reveal signs that the employee's health is affected by exposure to isocyanates in polyurethane paints.
- c) **Medical examination**—A medical examination by a doctor may reveal changes in normal health as a result of spray painting exposures. For example, a medical examination of employees who are exposed to hazardous substances that cause allergic contact dermatitis, for example, epoxy resins in epoxy paints or chromates in chromate-based paints, should include a careful check of the skin.



NOHSC:1005 (1994); NOHSC:2007 (1994); NOHSC:7039 (1995) - these are relevant to all of this chapter.

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C *9.7 has more information on when health surveillance should be carried out.*

A metabolite is a chemical that human bodies change the hazardous substance into.



NOHSC:1012 (1994); NOHSC:2015 (1994) - information on the biological monitoring of lead.



NOHSC:7039 (1995) - includes health surveillance guidelines for inorganic chromium. These apply to the use of chromate-based paints.

- d) **Medical history**—Taking a medical history can show that there have been changes in an employee’s health as a result of hazardous substances exposure. For example, the health surveillance procedures for isocyanates include the use of respiratory questionnaires.



*NOHSC:7039
(1995) -
includes health
surveillance
guidelines for
isocyanates.*

THE PURPOSE OF HEALTH SURVEILLANCE

9.4 Health surveillance helps to improve OHS performance by :

- a) checking whether risk control measures are adequate to protect employees’ health or need to be improved;
- b) reassuring people that appropriate risk control measures are in place;
- c) testing the validity of the risk assessment;
- d) offering measurable indicators to help with evaluation of occupational health and safety performance;
- e) giving individual employees early warning of health effects so that they can get follow-up medical attention before a serious health problem develops; and
- f) assisting with decision making by employers, employees and their representatives.

9.5 In addition, health surveillance procedures and results are sometimes used in research to evaluate the hazards of spray painting.

9.6 Employees should participate in health surveillance because it is designed to protect their health. If they are not sure about participating, they should talk to the doctor who is supervising the health surveillance.

WHEN IS HEALTH SURVEILLANCE REQUIRED?

9.7 The risk assessment should be used to decide whether health surveillance is required. If the risk assessment shows that health surveillance is necessary, then employers must provide it. Reasons for carrying out health surveillance include:

- a) **State/Territory/Commonwealth laws require it**—Some State/Territory/Commonwealth regulations require health surveillance for employees who are exposed to particular hazardous substances.
- b) **The risk assessment shows that there is a medium or high risk, or that a more detailed assessment is needed**—Health surveillance may be needed in these circumstances, where there are valid techniques for detecting the health effects caused by exposure to the substances involved.

*C 5.24 - levels of
risk; 5.30 - more
detailed
assessments;
Appendix 3 - an
example of a risk
assessment which
led to the
conclusion that
health surveillance
was required.*

- c) **Previous health surveillance results show that regular monitoring is needed**—Health surveillance procedures may have been carried out as part of the risk assessment or in response to health problems experienced by employees. The results of these procedures may show that regular health surveillance is needed until appropriate control measures can be put in place to eliminate or minimise the risk.
- d) **Evaluation of risk control measures**—The risk assessment could show that some control measures should be checked again to ensure that they work properly after implementation. For example, health surveillance can be used to see whether the masks chosen for spray painters are actually protecting their health, if there are valid techniques to detect the health effects caused by the substances being used.

9.8 If health surveillance is required, then it should be carried out at least annually.

WHO SUPERVISES HEALTH SURVEILLANCE?

9.9 Health surveillance procedures must be supervised by a doctor and must not be carried out by untrained people. The employer must consult with employees about the choice of doctor. Together, they should select a doctor who:

- a) shows a good understanding of their spray painting work and its implications for health and safety;
- b) shows a good understanding of doctors' legal duties under State, Territory or Commonwealth regulations on the control of workplace hazardous substances; and
- c) where relevant, is authorised by the local occupational health and safety authority to carry out health surveillance procedures for hazardous substances used in spray painting, or can show qualifications in occupational medicine or the appropriate health surveillance procedures.

DOCTORS' RESPONSIBILITIES

9.10 The employer and employees should expect that the doctor will:

- a) read the risk assessment report and help with the planning and implementation of health surveillance;
- b) ask employees for their consent before any health surveillance procedures are carried out;
- c) keep all medical records up-to-date and confidential;
- d) tell each employee the results of his or her health surveillance tests and

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C 9.10



*NOHSC: 2007
(1994)*

explain the test results clearly;

- e) tell the employer whether action is needed to improve risk control measures;
- f) not tell the employer or anyone else details of any individual's health surveillance test unless the individual gives his or her written permission to do so; and
- g) tell the relevant authority of important health problems where State, Territory or Commonwealth regulations require this.

OHS

EMPLOYERS' RESPONSIBILITIES

9.11 Employers have the following responsibilities for health surveillance:

- a) pay for any reasonable expenses, for example, doctor's bills, medical tests, travelling expenses and time off work to be tested;
- b) tell employees the reasons for health surveillance and what it involves;
- c) arrange the details of health surveillance with employees so that the arrangements are acceptable to the employees, for example, appointments are made for convenient times and do not involve travelling long distances;
- d) give the doctor who is supervising the health surveillance access to the Hazardous Substances Register so that he or she can check through all the MSDS, and also access to the risk assessment reports;
- e) reassess existing control measures and provide appropriate control of risk if the doctor says that the tests show that an employee's health is being affected;
- f) consult with the doctor and any employee whose health has been affected seriously, together with the employee's representative, about the best way to prevent further exposures; and
- g) keep records of health surveillance confidential and keep them for 30 years.

C 4.20

These records can be used by the employer to demonstrate compliance with legal requirements and can also be used by researchers to evaluate health effects of spray painting.

10. DEFINITIONS

In this national guidance material:

‘Breathing zone’ means a hemisphere of 300 mm radius extending in front of the face and measured from the midpoint of an imaginary line joining the ears. (See also ‘exposure standard’.)

‘Confined space’ means an enclosed or partially enclosed space which is at atmospheric pressure during occupancy and which is not intended (or designed) primarily as a place of work. A confined space may have restricted means for entry and exit. It may also:

- a) have an atmosphere that contains contaminants;
- b) not have safe oxygen levels; or
- c) cause engulfment.

Confined spaces may include, but are not limited to:


- storage tanks, tank cars, process vessels, boilers, pressure vessels, silos and other tank-like compartments;
- open-topped spaces such as pits or degreasers;
- pipers, sewers, shafts, ducts and similar structures; and
- any shipboard spaces entered through a small hatchway or access point, cargo tanks, cellular double bottom tanks, duct keels, ballast and oil tanks, and void spaces, but not including dry cargo holds.

‘Contaminant’ means a potentially harmful airborne substance that is either:

- a) not naturally present in air; or
- b) is present in an unnaturally high concentration.

‘Employee representative’ means an employee member of a health and safety committee, or a person elected to represent a group of employees on health and safety matters.

‘Exposure standard’ means an airborne concentration of a particular substance in a person’s breathing zone, as established by the National Occupational Health and Safety Commission’s *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*.

AS / 
Definition of a confined space is in accordance with AS2865/NOHSC 1009 (1994).



NOHSC:1003 (1995)

‘Hazard’ means the potential to cause harm (injury or illness).

‘Hazard zone’ means an area in which an explosive atmosphere is present, or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of potential ignition sources. In spray painting, both spray zones and paint mixing or tinting areas may contain hazard zones.

‘Hazardous substances’ means substances which:

- a) are listed on the National Occupational Health and Safety Commission’s *List of Designated Hazardous Substances*; or
- b) have been classified as a hazardous substance by the manufacturer or importer in accordance with the National Occupational Health and Safety Commission’s *Approved Criteria for Classifying Hazardous Substances*.

‘Must’ means a requirement. In this national guidance material ‘must’ is generally used when referring to requirements from the *National Model Regulations for the Control of Workplace Hazardous Substances*, the *National Standard for Plant* or other national standards. However, these regulations and standards are only mandatory when they are ‘taken up’ in State, Territory or Commonwealth legislation.

‘Paint’ is a product in liquid or powder form which, when applied to a surface, forms a dry film having identification, protective, decorative or other specific technical properties.

‘Plant’ includes any machinery, equipment, appliance, implement or tool and any component or fitting thereof or accessory thereto. In spray painting, plant may include, but is not limited to, spray booths, spray guns, pumps, compressors, hoses, ventilation systems, paint mixers, bake ovens and respirators.

‘Prohibited substance’ means a substance listed in Schedule 2 of the National Occupational Health and Safety Commission’s *National Model Regulations for the Control of Workplace Hazardous Substances*. [Note: Currently some jurisdictions list certain hazardous substances that are prohibited in spray painting in their respective hazardous substances legislation. Always seek advice from your local occupational health and safety authority about which hazardous substances are prohibited from use.]

‘Risk’ means the likelihood that a hazard will cause harm.

‘Should’ means a recommendation.



NOHSC:10005
(1999)



NOHSC:1008
(1999)



NOHSC:1005
(1994);
NOHSC:1010
(1994)

OHS



NOHSC:1005
(1994)

OHS

‘Source of ignition’ means a source of energy sufficient to ignite a flammable atmosphere, which may include naked flames, exposed incandescent material, electrical welding arcs, mechanical or static sparks and electrical or mechanical equipment not approved for use in hazardous locations.

‘Spray painting’ means the process in which a liquid coating substance, such as paint or lacquers, is converted into a mist or aerosol which is directed onto a surface to produce a desired film of the required thickness and texture.

‘Spray painting substance’ means a substance used in spray painting and includes, but is not limited to, paints, powders, lacquers, paint removers, rust converters and removers, surface preparation products, resins, solvents and thinners.

‘Spray zone’ means a designated area within which spray painting is, or has been, taking place, with restrictions on entry. A spray zone is designed to prevent exposure to hazardous substances, whereas a hazard zone (see above) is designed to prevent fire and explosion. Different requirements apply to spray zones and hazard zones.

AS *Definition of spray painting from AS/NZS 4114.*

C 6.17–6.20

INTERPRETING MSDS

Below is a blank MSDS form, with guidance on the information that can be found in the various sections.

COMPANY DETAILS

Company
Address
Telephone Number:
Emergency Telephone Number:

Page 1 of 2
Date of issue:

MATERIAL SAFETY DATA SHEET

STATEMENT OF HAZARDOUS NATURE

IDENTIFICATION

Product Name:
Other Names:
Manufacturer's Product Code:
UN Number:
Dangerous Goods Class and Subsidiary Risk:
Hazchem Code:
Poisons Schedule Number:
Use:

Physical Description/Properties

Appearance:
Boiling Point (range)/Melting Point (range):
Vapour Pressure:
Specific Gravity:
Flashpoint:
Flammability Limits:
Solubility in Water:

Other Properties

Auto-ignition Temperature:
Vapour Density:

Ingredients

Chemical Name: CAS Number: Proportion:

Identification contains information on the properties of the chemical or chemical product. This section will help you to identify hazardous substances during **hazard identification—Step 1 of the four step process.**

Dangerous Goods Class tells you the kind of danger, for example, Class 3—flammable liquids.

A Low Boiling range tells you that there is a greater fire hazard if the substance is a flammable liquid (the Dangerous Goods Class tells you whether it is a flammable liquid).

Flashpoint tells you the temperature at which the substance or its vapour will ignite if exposed to naked flame or sparks. A *low flashpoint* means a high fire hazard.

Degree of fire hazard	Flashpoint (°C)
Extreme	< 23
High	23 - 61
Moderate	62 - 93

Flammability Limits (Explosive Limits) - the greater this range, the greater the fire hazard.

Auto-ignition Temperature is the temperature at which the product will start burning even if there is no ignition source.

Ingredients tells you what is in the chemical product. You can check if paints that you work with contain any prohibited hazardous substances.

HEALTH HAZARD INFORMATION**Health Effects***Acute:*

Swallowed:

Eye:

Skin:

Inhaled:

*Chronic:***First Aid**

Swallowed:

Eye:

Skin:

Inhaled:

First Aid Facilities:

Advice to Doctor:**PRECAUTIONS FOR USE**

Exposure Standards:

Engineering Controls:

Personal Protection:

Flammability:

SAFE HANDLING INFORMATION

Storage and Transport:

Spills and Disposal:

Fire/Explosion Hazard:

OTHER INFORMATION

Manufacturer's advice:

CONTACT POINT:

Health Hazard Information and *Precautions for Use* are both sources of information for doing your **risk assessment—Step 2 of the four step process**. The risks are minimised if effective controls are in place.

Acute tells you about the short term health hazards of the product for each of the ways that you can be exposed to the product.

Chronic tells you about the long term health hazards of the product.

First Aid tells you about treating an injury.

Precautions for Use contains vital information for risk assessment, and on how to minimise the risks to health by establishing and maintaining **effective controls—Step 3 of the four step process**.

Personal Protection tells you the equipment required.

Flammability tells you how to prevent the fire/explosion hazards of the product.

Storage and Transport tells you how the product should be stored and transported and gives details of special storage facilities if they are needed.

Spills and Disposal describes how to dispose of a product with due regard to the environment.

Fire/Explosion Hazard gives emergency services the information they need to deal with a fire or explosions, including the fumes given off from a product and recommendations for fighting the fire.

HAZARD CATEGORIES OF SPRAY PAINTING SUBSTANCES

The tables below are an expansion of the information and recommendations at 5.20. The risk phrases referred to in this appendix may be found in Appendix 3 of the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(1999)] and in Appendix 1 of the *List of Designated Hazardous Substances* [NOHSC:10005(1999)]. These risk phrases are adopted by the European communities in EC Council Directive 67/548/EC3 to decide health effects and how they apply to Australia.

HAZARDOUS PROPERTY	EXAMPLES	WORKPLACE INFORMATION TRIGGERS	SOURCE
Category 1 (HIGH HAZARD) Substances			
1. Is, or contains, a cancer causing chemical	Chromates (see Chromium VI) R49 R43	Exposure Standard Health surveillance Label: "May cause cancer by inhalation" R49	[NOHSC:1008 (1999)] [NOHSC:2011 (1994)] [NOHSC:3008 (1995)] [NOHSC:1003 (1995)] [NOHSC:1008 (1999)] [NOHSC:2012 (1994)]
	Coal tar R45	Label: "May cause cancer" R45	
	Formaldehyde R40 R43, R23/24/25, R34	Exposure Standard Label: "Possible risk of irreversible effects" R40	
	*Cadmium	Carcinogen category *Some cadmium compounds require: Label: R49, R45, R40	
2. Is, or contains, a skin or respiratory sensitiser	Chromates R43 R49	Label: "May cause sensitisation by skin contact" R43	[NOHSC:2011 (1994)] [NOHSC:3008 (1995)] [NOHSC:1003 (1995)] [NOHSC:1008 (1999)] [NOHSC:2012 (1994)]
	Epoxy resins R43 R36/38		
	Formaldehyde R43 R23/24/25, R34, R40	Exposure Standard	
	Isocyanates	Exposure Standard Health surveillance Label: "May cause sensitisation by inhalation and skin contact" R42/43	
3. Is, or contains, a substance which cause reproductive effects	Ethoxyethyl acetate R60/61 R20/21/22	Exposure Standard Label: "May impair fertility" R60 Label: "May cause harm to unborn child" R61	[NOHSC:1008 (1999)] [NOHSC:2012 (1994)]
	Lead compound R61/62 R20/22, R33	Label: "Possible risk of impaired fertility" R62	

HAZARDOUS PROPERTY	EXAMPLES	WORKPLACE INFORMATION TRIGGERS	SOURCE
Category 1 (HIGH HAZARD)	Substances (continued)		
4. Is, or contains, a substance which cause severe effects after repeated or prolonged exposure	Tributyltin compounds R48/23/25 R36/38, R25, R21 Lead compounds R33 R61/62, R20/22 Mercury R33 R23 *Cadmium	Label: “Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed” R48/23/25 Label: “Danger of cumulative effects” R33 *Some Cadmium compounds require: Label: “Toxic” R48/23/25 Label: “Danger of cumulative effects” R33	[NOHSC:1008 (1999)] [NOHSC:10005 (1999)]
5. Is, or contains, a metallic compound which is a hazardous substance	Lead Lead compounds R61/62 R20/22, R33 Mercury R33 R23 Cadmium compounds R20/21/22	Exposure Standard. Health surveillance Label: “May cause harm to unborn child” R61 Label: “Possible risk of impaired fertility” R62 Label: “Danger of cumulative effects” R33 Label: “Toxic by inhalation” R23 Label: “Harmful by inhalation and if swallowed” R20/22 Label: “Harmful by inhalation, in contact with skin and if swallowed” R20/21/22	[NOHSC:1008(1999)] [NOHSC:2012(1994)]
6. Is, or contains, a substance that cause non-lethal irreversible effects	Formaldehyde R40 R34, R43, R23/24/25 *Cadmium	Exposure Standard Label: “Possible risk of irreversible effects” R40 *Some Cadmium compounds require: Label R40	[NOHSC:2012(1994)]
7. Is, or contains, a substance which cause acute irritant effects	Epoxy resins R36/38 R43 Styrene R36/38 R20 Methyl ethyl ketone R36/37 Tributyltin compounds R36/38 R48/23/25, R25, R21 2-butoxyethanol R37 R20/21/22	Label: “Irritating to eyes and skin” R36/38 Exposure Standard Label: “Irritating to eyes and skin” R36/38 Exposure Standard Label: “Irritating to eyes and respiratory system” R36/38 Label: “Irritating to eyes and skin” R36/38 Exposure Standard Label: “Irritating to respiratory system” R37	[NOHSC:1008 (1999)] [NOHSC:2012 (1994)]

HAZARDOUS PROPERTY	EXAMPLES	WORKPLACE INFORMATION TRIGGERS	SOURCE
Category 1 (HIGH HAZARD) Substances (continued)			
8. Is classified as a Poison Schedules 6 or 7	Tributyltin compounds R48/23/25, R36/38, R25, R21 Lead compound R61/62, R20/22, R33 Mercury R33, R23 Cadmium Isocyanates	Label: "Poison" or "Dangerous Poison"	ACTDG
9. Is, or contains, corrosive substances or Dangerous Goods Class 8 products	Formaldehyde R34 R40, R43, R23/24/25	Exposure Standard Label: "Corrosive. Cause burns" R34	[NOHSC:1008(1999)] [NOHSC:2012(1994)] Australian Code for the Transport of Dangerous Goods (ACTDG)
10. Is a DG Class 5 product		MSDS says DG Class 5.1, 5.2. Label shows a DG Class 5 diamond	ACTDG
11. Is a 2 or more pack paint	A polyurethane paint and its hardener	MSDS Label	
Category 2 (MEDIUM HAZARD) Substances			
Does not contain any substance that meets Category 1 criteria, AND either a) Contains organic solvents (may include water-based products), or b) Is a DG Class 3 product	2-butoxyethanol in water-based paints	MSDS Label Label shows a DG Class 3 diamond	ACTDG
Category 3 (LOW HAZARD) Substances			
Does not contain any substance that meets Category 1 or Category 2 criteria		MSDS Label	

EXAMPLES OF RISK ASSESSMENT

RISK ASSESSMENTS THAT LED TO THREE DIFFERENT CONCLUSIONS—‘HIGH RISK’, ‘MEDIUM RISK’ AND ‘LOW RISK’

High risk

A large assembly plant employs two painters full time to spray paint truck panels with a two pack polyurethane finish. These employees prepare and mix the paint, carry out all spraying tasks and regularly clean up equipment for re-use. While all spraying work is conducted within a spray booth, the paint mixing and clean-up are conducted in the general factory area. The painters are issued with half-face filter organic vapour respirators and rubber gloves to be used during the spray painting process. The employer is considered to have sufficient skills to make a **risk assessment** of the existing hazards, risks and controls already in place.

While reviewing the existing practices, the employer discovers that both the label on the paint system and its accompanying MSDS indicate that the polyurethane system contains an isocyanate hardener and the organic solvent toluene. The paint system is classified Category 1 (High Hazard) Substance.

Risk and safety phrases on the label alert users to the specific health hazards and controls which need to be used.

Health Hazards Information in the MSDS reveals that isocyanates can cause respiratory irritation and sensitisation (asthma), as well as skin sensitisation from prolonged exposure and are considered capable of causing severe harm to the users.

When the employer questions the painters, it is discovered that one has suffered occasional asthma attacks since childhood.

Precautions for Use in the MSDS reveals that the manufacturer’s requirements include the mandatory use of supplied air breathing equipment, a full skin covering and eye protection.

To determine the adequacy of the existing filter respirators, the employer seeks advice from a suitably qualified consultant or employee, in this case a hygiene consultant.

The hygiene consultant explains that:

- the **exposure standards** referred to in the MSDS are very low because of the potency of the substance and its capacity to cause respiratory sensitisation;
- the vapour concentrations to which the painters are exposed during spraying may exceed the exposure standard by a factor of more than 100; and
- the existing filter respirators cannot provide the protection required.

While inspecting the work areas, the employer notes the potential for exposure to skin, eyes and respiratory tract by inhalation during spraying.

A strong solvent odour is present in the spray booth. 'Bystander' employees, however, do not appear to be at risk because all spraying is conducted only within the spray booth.

As soon as the painters complete the spraying, they are seen to remove their respirators while still remaining in the spray booth.

The procedure of mixing paint and cleaning spray painting equipment is performed in the open without specific precautions. This has an unknown level of risk. However, it is unlikely to be low risk, considering the nature of the paint and the frequency of the tasks.

The employer concludes that the level of risk in the spray painting process using the polyurethane system is **HIGH RISK**. The conclusion is based on the high likelihood of exposure to the skin, eyes and respiratory system and the potential for harm from the paint substances. The reasons for the conclusion are:

- skin protection from the rubber gloves used during the process is inadequate for all the body;
- no eye protection is provided for the painters;
- respiratory protection is inadequate for a respiratory sensitising agent with a low exposure standard—air monitoring is not required to confirm the degree of over exposure; and
- health effects to the skin and to the respiratory system can be severe from over exposure.

As a result of this risk assessment, the employer decides that **air monitoring** is not needed and that **health surveillance** of the workers is required because one worker has a previous history of a respiratory condition (asthma), and the currently used respiratory protection is inadequate.

The corrective measures put in place include:

- health surveillance which is organised in consultation with the employees;
- controls in the form of air-supplied respirators with full-face pieces for eye protection and better whole body protection; and
- appropriate induction and training so that the employees understand the hazards, risks and new control equipment.

Medium risk

A cabinet making workshop manufactures reproduction rustic kitchen furniture from recycled housing timber. The finished furniture is spray painted with a clear lacquer on the open factory floor. One employee conducts all painting operations, but employees working nearby (approximately 15–18 metres away) are regularly exposed to vapours from overspray which are easily detected by odour. The employer is considered capable of conducting the **risk assessment** of the existing hazards, risks and controls already in place.

While undertaking the risk assessment, the employer notes that the label affixed to the tin containing the lacquer and organic solvent mixture bears **risk phrases** indicating

the flammable nature of the solvent, danger from inhalation of the vapour and the effect of the solvent on the skin. The label also contains **safety phrases** relating to safe handling of the paint solvent system.

The MSDS for the paint-solvent system contains the following relevant information:

- **Ingredient Information** which indicates that the paint solvent system consists of sec-amyl acetate and acetone. The system is classified Category 2 (Medium Hazard) Substance;
- **Health Hazard Information** advises that risks to health (respiratory irritation, dizziness and narcosis at high concentrations) can arise from inhalation of vapours and skin can be defatted by prolonged exposure to the liquid paint;
- **Exposure Standards** for sec-amyl acetate and acetone with time-weighted averages (TWA) are listed at 125 ppm and 500 ppm respectively; and
- **Short Term Exposure Limit** (STEL) for acetone is listed at 1000 ppm.

The review of the work procedures indicates that:

- spray painting in the open with a low pressure high volume air system results in high amounts of vapour which, as the solvent evaporates, primarily concentrate in the breathing zone of the spray painter;
- during the spray gun and pot clean-up, solvent is liberally applied, but no dermal (glove) protection is used;
- the solvent soaked rags are thrown into an open container and, as the solvent evaporates from the rags, a fire and explosion hazard is created; and
- the only control used is a particulate mask which prevents aerosol inhalation by the spray painter.

As part of the assessment, the employer arranges for **air monitoring** of the solvent vapours in the breathing zone of the spray painter. It is established that the short term peak exposures during spraying were 1,500 ppm for the acetone and 400 ppm for the sec-amyl acetate. These levels occur eight times per shift for about 15 minutes each time. Air monitoring in adjacent work areas establishes that the solvent content in the air reaches a maximum of 50 ppm for the acetone and 8 ppm for the sec-amyl acetate.

The risk assessment concludes **MEDIUM RISK** based on:

- a high probability of inhalation of vapour by the spray painter when protected only by a particulate mask;
- a likelihood of high concentrations of vapour generated in the workplace by painting without an extraction system;
- potential low to medium risk through inhalation of high concentrations of acetone and sec-amyl acetate created during spraying; and
- potential risk of skin damage through exposure to solvents during regular cleaning of spray guns and pots.

The corrective action taken by the employer includes:

- upgrading respiratory protection;
- providing dermal (skin) protection during spraying and clean-up operations; and
- providing overalls for whole body protection.

Air monitoring has confirmed that the 'bystander' employees are not excessively exposed to risk and that their separation is adequate. The risk assessment did not indicate a need for health surveillance.

Low risk

A painter is engaged in a task of spraying walls and ceilings in a new high rise building. Paint is applied by using both low pressure air and airless spray techniques. The work consists of a continuous cycle of preparation, painting and cleaning up with spraying comprising approximately 50 per cent of total shift time. At present, the worker uses no protection. The employer is considered capable of undertaking the **risk assessment**.

The container label indicates that the paint used is a polyvinylalcohol resin and water based single package paint system.

The MSDS indicates that the paint contains no substances which classify it as either High Hazard or Medium Hazard. This paint system is classified Category 3 (Low Hazard) Substance.

The **Health Hazard Information** in the MSDS does not mention any specific health concerns.

Precautions for Use in the MSDS requires no special precautions for rolling and brushing, but for spraying, eye protection and a respirator to prevent inhalation are recommended.

The review of the work processes indicates a relatively minor amount of overspray with the airless system and greater amount with the air system.

Reference to the PPE recommendations (Appendix 7 of this national guidance material) for Category 3 substances shows that for indoor use without ventilation the following precautions are required:

- full-face respirator with Class 3 filters and external prefilter (this will provide the required eye protection);
- disposable overalls, probably cellulose; and
- cotton gloves.

MSDS data states that special skin protection is not required because no skin effects are evident.

The risk assessment identifies that the spray painting process is **LOW RISK** because:

- the likelihood of exposure is small;
- the potential harm from the resin and its filters are low;
- decisions on protection are simple and straightforward;
- detailed examinations of the work practices are not required; and
- the implementation of the controls is straightforward and uncomplicated.

A sample risk assessment worksheet can be found on the following page.

SAMPLE RISK ASSESSMENT WORKSHEET

This is a sample worksheet from a workplace where Category 1 paints were being used with inadequate risk controls. The risk assessment includes recommendations on the level of controls needed.

LOCATION	Main Spray Painting and Baking Line	ASSESSOR T. Gunn	DATE 14 5 97		
TASKS	Paint Mixing	Colour Matching	Spraying	Baking	Clean Up
HAZARDS IDENTIFIED	<p>Paints, vapour and aerosols; cleaning solvent - possible liquid content and solvent vapour. Static electricity - flammable solvents - fire. Explosion hazard from sprayed paint and solvent system. Noise arises from booth extraction and spray guns. Ergonomic issues - work in awkward postures, heat stress, visibility, communication. Electrical hazards - operation of extraction booth; drying booth electrically operated.</p>				
REVIEW OF HAZARDS	<p><i>Labels</i> Paint system XYZ indicates hardener contains HDI - hexamethylene diisocyanate. Paint identified as Category 1. Risk and safety phrases present. <i>MSDS</i> XYZ system cautions against breathing paint spray and aerosol; respiratory irritation and sensitisation, avoidance of skin contact with uncured paint, possibility of skin sensitisation. MSDS advises use of air supplied respirator and skin protection. <i>PLANT</i> Generation of explosive atmospheres by spraying, flammable solvents and rags: need to have ignition proof environment.</p>				
STAFF AND PERSONNEL	Workers ---- Work Schedule ----	P Pott, L. Noyes, D. Blue. Approx 1.5 hr prep mixing, 5 hr spraying and 1.5 hr clean up.			
POSSIBLE EXPOSURES IN EACH TASK	<p>Paint Mixing Conducted on open bench with good natural ventilation; possible static electricity; exposure of skin to paint; inhalation of vapour possible. Determine need for PPE by use of air monitoring. Vapours arising during decanting and from wiping rags.</p>	<p>Colour Matching Conducted indoors, no ventilation, intermittent inhalatory exposure to spray paint aerosols. Hands protected but body unprotected.</p>	<p>Spraying Conducted in spray booth. Possible inhalatory exposure route. Skin exposure possible to whole of body. Possibility of skin injection injuries. Heat stress in hot weather with unbroken work. Noise from extraction system and spray gun.</p>	<p>Baking Vapours from curing paint and solvents. Access to drying line unusual</p>	<p>Clean Up Skin exposure extreme to gun washing solvents. Inhalation of cleaning solvent and residual paint vapours as conducted in open. Area contaminated by solvent in cleaning rags.</p>
EXISTING CONTROL	None.	Latex gloves only.	Half-face respirator (Class 2). Latex gloves, spray booth AS4114.	None.	Latex gloves only.
POTENTIAL FOR EXPOSURE	Skin - high. Inhalation – possible vapour.	Skin - high. Inhalation – high.	Skin - high. Inhalation - extremely high.	Skin - none. Inhalation – moderate.	Skin - high. Paint inhalation - moderate.

RECOMMENDED CONTROL

Chemically resistant gloves. Conduct air monitoring for isocyanate and solvent vapours to determine level of respiratory protection needed. Static spark arrester.

Conduct colour matching in the spray booth with AIR SUPPLIED RESPIRATOR or conduct colour matching in a specially constructed extracted booth. Skin protection by chemically resistant gloves required.

See Appendix 7, use of air supplied respirator is required. NO LESSER PROTECTION WILL SUFFICE. Full body protection. Gloves and eye protection mandatory. Boots and boot covers. Continued use of spray booth. Build extra work breaks into schedule in hot weather. Ear protection against noise.

If entry is required, wearing of air supplied respirator is preferred. Air monitoring may establish the need for Class 3 organic and gas vapour filtering respirator.

Skin - hand and arm dermal protection required. Chemically resistant gloves. Inhalation protection from solvent vapours by use of air supplied respirator. Alternatively, conduct all equipment cleaning in an automatic solvent washing system.

MONITORING AND HEALTH SURVEILLANCE

Risk assessment shows air monitoring should be conducted on paint mixing to determine if exposure to isocyanates is sufficiently high to require use of respiratory protection. Air monitoring also to be conducted on clean up to determine need for respiratory protection. Health surveillance by doctor to be provided for all workers who previously worked with insufficient controls (half-face respirator and latex gloves).

SPECIAL CONTROL MEASURES FOR ELECTROSTATIC SPRAY PAINTING

A4.1 In an electrostatic spraying system, atomised droplets are charged to a high voltage (at least 60 kV) so that they are attracted to an earthed workpiece. This has the advantage of reducing the amount of ricochet and overspray.

A4.2 The ignition of solvent vapour by an electrical discharge is a specific hazard of electrostatic spraying. Generally speaking, ignition may be caused either by a direct electrical discharge from the gun to the workpiece, or by discharge of an unearthed object that has been charged by induction or contact. There is therefore a risk of electric spark ignition both at the spray gun nozzle and at the wetted surface of the workpiece.

A4.3 Due to the ignition hazard, the precautions listed below should be observed in addition to the precautions described elsewhere in this guide.

GENERAL

A4.4 The equipment should only be operated by trained personnel who should be fully conversant with the safety precautions described below and in AS 2268.

SPRAY ZONES/BOOTHS

A4.5 Electrostatic spraying should be carried out in a spray zone exclusively reserved for such work. (See 6.14–6.20 and Appendix 6 for spray zones.) Booths and similar enclosures should be fire-resistant and have adequate ventilation, as described in Chapter 6. In particular, the floor should be made of electrically-conducting material and it should be earthed.

INSTALLATION

A4.6 Only the spray gun and the cables connected to it should be in the spray zone. All other associated electrical apparatus, for example, power pack, motor-driven compressor and mains connections, should be located outside the zone, or be enclosed separately in a fire-resistant structure, unless the equipment is suitably certified for use in a hazard zone. (See Chapter 10 for the definition of a hazard zone.)

A4.7 Such equipment should be protected so that it does not get paint on it, as paint residues may be flammable.

VENTILATION

A4.8 Spraying should be carried out only when the spray zone has adequate ventilation. It is recommended that the exhaust system provides an air movement of at least 0.4 metres/second at the spray position, with the direction of the flow from the operator towards the workpiece. Higher extraction rates may be required for more hazardous vapours. The point of extraction should preferably be at low level.

EARTHING OF EQUIPMENT

A4.9 All equipment and metal surfaces within a radius of 3 metres from the charged head of the spray gun should be earthed to avoid the build-up of static charges that could cause ignition. This applies as follows:

- a) The floor of the spray zone should be of a material that is electrically conducting to the earthing of the spray gun. Ordinary bare concrete is generally suitable, but any permanent or temporary covering or coating on the concrete must itself be conducting. The concrete should have a conductivity acceptable to the relevant public authority. Any overspray should be cleaned from the floor to avoid the build-up of an insulating layer.
- b) The metal housing and handle of the gun or the metal areas on the handle of the gun and any metallic screen of the high voltage cable should be effectively earthed.
- c) Each workpiece should be efficiently earthed. Earthing is frequently done through metal suspension hooks. It is essential that such hooks are regularly and frequently cleaned to avoid the build-up of an insulating coating of paint.

EARTHING OF PERSONNEL

Clothing other than footwear

A4.10 Persons in the spray zone who could attain a charge in the course of their work should not wear metal articles. Finger rings are the only exception to this.

A4.11 Care should also be taken in the choice of clothing. Clothing of silk or synthetic fibres can generate and accumulate static electricity unless regularly treated with antistatic solutions. Static discharges are likely to emanate from such untreated clothing when it is loose-fitting, or when it is tight-fitting but loses contact with the skin.

A4.12 Clothing of silk or synthetic fibres (or other non-conductive materials) is therefore not recommended in areas where flammable materials are likely to be present, unless it is rendered conductive by commercially available antistatic solutions. It is important to realise that such solutions may be effective only for limited periods and should therefore be applied at regular intervals (at least every time the garment is washed).

A4.13 Gloves worn by the operator must be non-insulating gloves.

Footwear

A4.14 Two types of footwear, antistatic and conductive, are recommended to prevent the accumulation of electrostatic charge in a person.

A4.15 Antistatic footwear must have a resistance of not greater than 10×10^7 ohms to provide a dissipation path to earth for charges accumulated on a person, but is also required to have a resistance of not less than 7.5×10^4 ohms to provide protection against electric shock from supply mains.

A4.16 Leather-soled footwear may not always be sufficiently conductive to give protection against build-up of static.

A4.17 All types of footwear can be adapted to provide a conductive path by incorporating a conductive garter which is strapped in contact with the skin of the wearer's leg and which makes electrical contact with a sufficiently large area on the sole of the footwear.

A4.18 Care should always be taken to ensure that the antistatic or conductive properties of footwear are not impaired, for example, by ageing or the formation of insulating layers such as paint, oil or wax on the sole. The likelihood of this happening may increase if the footwear is worn outside the danger area. It is therefore recommended that the resistance of footwear be tested at regular intervals. The resistance may be measured between electrodes placed on the inside and outside of the sole, the size and contact pressure of the electrodes being commensurate with conditions prevailing in normal use. Some equipment is in use, however, in which the resistance is measured while the footwear is being worn.

A4.19 Dissipation of static electricity from a person by the use of any type of antistatic or conductive footwear is effective only if the person:

- a) stands on a conductive floor; and
- b) wears socks made from fabric other than silk or synthetic fibres, or has treated their silk or synthetic fibre socks with antistatic solutions as described in A4.11-A4.12.

Other means of earthing persons

A4.20 The following methods of earthing persons may be used. However, the danger of electric shock from mains supply, the possible need for quick evacuation from a dangerous area, psychological effects and the work movements of the person should be considered in each case:

- a) frequent grasping of an earthed handle; and
- b) a metal wrist strap connected to earth by a flexible lead.

HANDLING OF PAINT AND CLEANING SOLVENT

A4.21 No drums of paint or cleaning solvent should be allowed in the spray zone while spraying is in progress.

Cleaning the spray gun

A4.22 The cleaning solvent should have a flash point of not less than 23°C and preferably above the potential ambient temperature.

A4.23 Only a metallic solvent container may be used and it should be efficiently earthed.

A4.24 The gun should not be cleaned with the high voltage supply switched on.

DUTIES OF SUPPLIERS, IMPORTERS, MANUFACTURERS AND DESIGNERS OF PLANT¹

A5.1 A **supplier** has to ensure that:

- a) The purchaser (or owner) of new plant is given the health and safety information that the supplier gets from the manufacturer.
- b) The purchaser (or owner) of used plant is given:
 - i) health and safety information from the designer and manufacturer that is available, and
 - ii) any record kept by the previous owner of the plant required under the *National Standard for Plant*, where available.
- (c) Where plant is not under the supplier's management and control, as far as practicable, any faults are identified. The purchaser or owner must then be advised in writing (prior to the plant being supplied) of the faults and, where appropriate, that the plant is not to be used until the faults are rectified.

A5.2 An **importer** has to give the purchaser (or owner) of used plant health and safety information from the designer and manufacturer that is available, and any additional available information that is needed so the plant can be used safely.

A5.3 A **manufacturer** has to give the supplier:

- a) all information provided by the designer (see A5.4); and
- b) any document relating to testing.

A5.4 A **designer** has to give the manufacturer the information needed for the plant to be manufactured in accordance with the design specifications and, as far as practicable, with information relating to:

- a) the purpose for which the plant is designed;
- b) testing or inspections to be carried out on the plant;
- c) installation, commissioning, operation, maintenance, cleaning, transport, storage and, where plant is capable of being dismantled, dismantling of the plant;

¹ This appendix is a summary of the duties of suppliers, importers, manufacturers and designers. For more information see the *National Standard for Plant*.

- d) systems of work necessary for the safe use of plant;
- e) knowledge, training or skill necessary for persons undertaking inspection and testing of the plant; and
- f) emergency procedures.

A5.5 A manufacturer must assume the responsibilities that would otherwise be the responsibilities of the designer where the designer is outside Australia. An importer must assume the responsibilities that would otherwise be the responsibilities of the designer and manufacturer where the designer and manufacturer are outside Australia.

SPRAY ZONES FOR DIFFERENT CATEGORIES OF SUBSTANCES IN DIFFERENT VENTILATION CONDITIONS

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS	SOURCE	COMMENTS
Category 1 (HIGH HAZARD) Substances				
1. Inside closed spray booth complying with AS/NZS 4114.1.	According to AS 4114, distances regarding ignition do not apply outside a closed spray booth.	At least 5 minutes after spraying with spray booth operating.	AS/NZS 4114.1	<p>The distance and time factors indicated in this table for Category 1, 2 and 3 substances may not be practicable for all conditions. Hazard controls from the risk of explosion and the inhalation of hazardous substances will depend on the conditions under which certain types of paints are applied and must always be selected as part of a risk assessment and control process.</p> <p>The hazard control factors of distance and time referred to in Appendix 6 are provided as a guide and are based on AS/NZ 4114.1 Spray Painting Booths and AS 2430.1 Classification of Hazardous Areas – Explosive Gas Atmospheres.</p>
2. Inside exhaust ventilated enclosed area (for example, blast unit, closed hangar with exhaust ventilation, temporary enclosure supplied with local exhaust ventilation, for example, 'mucksucker'; domestic bathroom with doors and windows sealed and supplied with local exhaust ventilation).	At least 6 metres horizontal and 3 metres vertical.	At least 30 minutes after spraying with ventilation operating.	Principles from AS 2430.	

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS	SOURCE	COMMENTS
Category 1 (HIGH HAZARD) Substances (continued)				
3. Inside open spray booth complying with AS/NZS 4114.1.	At least 2 metres extending in all directions from any opening or outlet.	At least 5 minutes after spraying with spray booth operating.	AS/NZS 4114.1	
4. Spray painting indoors without exhaust ventilation.	Category 1 paints should not be sprayed for any reason (including touch up) without exhaust ventilation, unless other suitable means of safely limiting exposure to those in the area are in place.			Spray painting indoors without ventilation is prohibited by law in some jurisdictions. Always check with your local OHS Authority for guidance on the relevant regulations.
5. Spray painting outdoors.	Distances should be determined by conducting a risk assessment.	Until concentration of volatile organic solvent or other volatile components has dropped below exposure standard.	<i>Polyurethane Coatings: performance, quality, safety,</i> Bayer, 1989, Pittsburgh Principles from AS 2430.	<ul style="list-style-type: none"> - Air quality can be monitored to ensure concentrations are not exceeding exposure standards. This may lead to the spray zone distances being adjusted, for example, greater windspeed, higher temperatures and low humidity mean that fumes and vapours spread further and a larger spray zone may be required. - Risk assessment to determine vertical distance if required. - Administrative and PPE controls must be used for touch up.

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS	SOURCE	COMMENTS
Category 2 (MEDIUM HAZARD) Substances				
1. Inside closed spray booth.	According to AS 4114, distances regarding ignition do not apply outside a closed spray booth.	At least 5 minutes after spraying with booth operating.	AS/NZS 4114.1.	<p>The distance and time factors indicated in this table for Category 1, 2 and 3 substances may not be practicable for all conditions. Hazard controls from the risk of explosion and the inhalation of hazardous substances will depend on the conditions under which certain types of paints are applied and must always be selected as part of a risk assessment and control process.</p> <p>The hazard control factors of distance and time referred to in Appendix 6 are provided as a guide and are based on AS/NZ 4114.1 Spray Painting Booths and AS 2430.1 Classification of Hazardous Areas – Explosive Gas Atmospheres.</p>
2. Inside exhaust ventilated enclosed area.	At least 6 metres extending in all directions from any opening or outlet.	At least 30 minutes after spraying with ventilation operating.	Principles from AS 2430.	
3. Inside open spray booth.	At least 2 metres extending in all directions from any opening or outlet.	At least 5 minutes after spraying with booth operating.	AS/NZS 4114.1.	

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS	SOURCE	COMMENTS
Category 2 (MEDIUM HAZARD) Substances (continued)				
4. Indoors without exhaust ventilation.	Distances should be determined by conducting a risk assessment.	Until concentration of volatile organic solvent or other volatile components has dropped below exposure standard.	Principles from AS 2430	<p>Should be avoided unless air monitoring can be used to confirm that all bystanders are not being exposed to vapours exceeding the exposure standards.</p> <p>Spray painting indoors without ventilation is prohibited by law in some jurisdictions. Always check with your local OHS Authority for guidance on the relevant regulations.</p>
5. Spray painting outdoors.	Distances should be determined by conducting a risk assessment.	Until concentration of volatile organic solvent or other volatile components has dropped below exposure standard.	<p><i>Polyurethane Coatings: performance, quality, safety,</i> Bayer, 1989, Pittsburgh</p> <p>Principles from AS 2430.</p>	<p>- Air quality can be monitored to determine concentrations are not exceeding exposure standards. This may lead to the spray zone distances being adjusted, for example, greater windspeed, higher temperatures and low humidity mean that fumes and vapours spread further and a larger spray zone may be required.</p> <p>- Risk assessment to determine vertical distance if required.</p> <p>- Administrative and PPE controls must be used for touch up.</p>

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS	SOURCE	COMMENTS
Category 3 (LOW HAZARD) Substances				
1. Inside open spray booth complying with AS/NZS 4114.1.		At least 5 minutes after spraying with booth operating.	AS 4114.1	<p>The distance and time factors indicated in this table for Category 1, 2 and 3 substances may not be practicable for all conditions. Hazard controls from the risk of explosion and the inhalation of hazardous substances will depend on the conditions under which certain types of paints are applied and must always be selected as part of a risk assessment and control process.</p> <p>The hazard control factors of distance and time referred to in Appendix 6 are provided as a guide and are based on AS/NZ 4114.1 Spray Painting Booths and AS 2430.1 Classification of Hazardous Areas – Explosive Gas Atmospheres.</p>
2. Inside exhaust ventilated enclosed area.	At least 6 metres extending in all directions from any opening or outlet.		Principles from AS 2430	
3. Inside open spray booth.	At least 2 metres extending in all directions from any opening or outlet.	At least 5 minutes after spraying with booth operating.	AS 4114.1	
4. Indoors without exhaust ventilation.		Until concentration of volatile components has dropped below exposure standard.	Principles from AS 2430	
5. Outdoors.	At least 3 metres in all directions.	No time restriction for re-entry.		

PERSONAL PROTECTIVE EQUIPMENT REQUIRED UNDER DIFFERENT VENTILATION CONDITIONS

All respiratory PPE should be selected after:

- reference to the manufacturer’s recommendations outlined in the relevant MSDS;
- the completion of a comprehensive risk assessment;
- reference to the minimum standards identified in AS/NZS 1715; and
- reference to State, Territory and Commonwealth legislative requirements.

VENTILATION CONDITIONS	PPE
Category 1 (HIGH HAZARD) and Category 2 (MEDIUM HAZARD) Substances	
<ol style="list-style-type: none"> 1. Inside a spray booth 2. Indoors with ventilation 3. Indoors without ventilation 4. Outdoors 	<p>Hearing protection Noise can come from:</p> <ul style="list-style-type: none"> • spray guns; • compressors; and • fans. <p>Hearing protection devices conforming to AS 1269 to reduce noise exposure to below the statutory limits.</p> <p>Respiratory protection Air-supplied full facepiece respirator or head covering respirator (may be disposable). This will also protect eyes and facial skin. Tested for fit prior to use and complying with AS/NZS 1716.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><i>The respiratory protection recommended for Category 1 and 2 substances may not be practicable for safety or operational reasons. In situations where the use of air-supplied respirators increases the risk of injury to the operator, alternative respiratory protection may be used.</i></p> <p><i>The respiratory protective equipment required will depend on the conditions under which the paints are applied and must be selected as part of the risk assessment and control process. The following points need to be considered:</i></p> <ul style="list-style-type: none"> • exposure standards for the various paint components; • the manufacturer’s MSDS; • ventilation in the areas where the paint is to be applied; • the exposure level and duration of exposure; • the protection factor of the respirator; • State, Territory and Commonwealth legislative requirements for PPE. </div>

VENTILATION CONDITIONS	PPE
Category 1 (HIGH HAZARD) and Category 2 (MEDIUM HAZARD) Substances (continued)	
	<p>Skin protection Full skin cover including:</p> <ul style="list-style-type: none"> • Disposable overalls and head covering (as needed); • impervious gloves (check MSDS); • boots; and • disposable protective boot covers.

Note: PPE protection should be the same for Category 2 substances as for Category 1 substances unless the risk assessment determines otherwise.

VENTILATION CONDITIONS	PPE
Category 3 (LOW HAZARD) Substances	
In all ventilation conditions	<p>Hearing protection Same as for Categories 1 and 2.</p>
1. Inside a spray booth	<p>Respiratory protection At least a full facepiece respirator with an external prefitted filter for particulates in combination with a Class 3 gas filter.</p> <p>Skin protection Determined by risk assessment, for example, overalls may not need to be disposable, head covering and/or boot covers may not be needed.</p>
2. Indoors with ventilation	<p>Respiratory protection At least a full facepiece respirator with an external prefitted filter for particulates in combination with a Class 3 gas filter.</p> <p>Skin protection Determined by risk assessment.</p>
3. Indoors without ventilation	<p>Respiratory protection At least a full facepiece respirator with an external pre-fitted filter for particulates in combination with a Class 3 gas filter.</p> <p>Skin protection Full skin cover including:</p> <ul style="list-style-type: none"> • disposable overalls and head covering (as needed); • impervious gloves (check MSDS); • boots; and • disposable protective boot covers.
4. Outdoors	<p>Respiratory protection At least a full facepiece respirator with an external prefitted filter for particulates in combination with a Class 3 gas filter.</p> <p>Skin protection Determined by risk assessment.</p>

REFERENCE LIST

NATIONAL STANDARDS, CODES OF PRACTICE AND GUIDANCE¹

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 2. National Occupational Health and Safety Commission, 'Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment', [**NOHSC:1003 (1995)**], in *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*, Australian Government Publishing Service, Canberra, 1995.
 3. National Occupational Health and Safety Commission, 'National Model Regulations for the Control of Workplace Hazardous Substances' [**NOHSC:1005 (1994)**], in *Control of Workplace Hazardous Substances: National Model Regulations and National Guidance Material*, Australian Government Publishing Service, Canberra, 1994.
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 5. National Occupational Health and Safety Commission, *Approved Criteria for Classifying Hazardous Substances*, [**NOHSC:1008 (1999)**], NOHSC, Sydney, 1999.
- [**NOHSC:1009 (1994)**] see 30.
6. National Occupational Health and Safety Commission, *National Standard for Plant*, [**NOHSC:1010 (1994)**], Australian Government Publishing Service, Canberra, 1994.
 7. National Occupational Health and Safety Commission, *National Standard for the Control of Inorganic Lead at Work*, [**NOHSC:1012 (1994)**], Australian Government Publishing Service, Canberra, 1994.
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 9. National Occupational Health and Safety Commission 'National Guidance Material for Control of Workplace Hazardous Substances' [**NOHSC:2007**

¹ For readers' convenience, National Occupational Health and Safety Commission documents are arranged in NOHSC number order. The NOHSC numbers appear in bold print.

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15. National Occupational Health and Safety Commission, *Guidance Note for the Assessment of Health Risks Arising from the Use of Hazardous Substances in the Workplace*, [NOHSC:3017 (1994)] Australian Government Publishing Service, Canberra, 1994.
16. National Occupational Health and Safety Commission, *Guidelines for Health Surveillance*, [NOHSC:7039 (1995)] Commonwealth of Australia, 1995-6.
17. National Occupational Health and Safety Commission, *List of Designated Hazardous Substances*, [NOHSC:10005 (1999)], NOHSC, Sydney, 1999.
18. National Occupational Health and Safety Commission, *Plant in the Workplace - Making It Safe: A guide to managing the risks from plant in the workplace for employers and employees*, Commonwealth of Australia, Canberra, 1995.

AUSTRALIAN AND NEW ZEALAND STANDARDS²

19. Standards Australia, **AS 1020** *Control of undesirable static electricity*, Standards Australia, Sydney.

² Australian and New Zealand standards are arranged in AS (or AS/NZS) number order. The AS or AS/NZS numbers appear in bold print.

20. Standards Australia, **AS 1269** *Acoustics - hearing conservation*, Standards Australia, Sydney.
21. Standards Australia, **AS 1319** *Safety signs for the occupational environment*, Standards Australia, Sydney.
22. Standards Australia, **AS 1345** *Identification of the contents of piping, conduits and ducts*, Standards Australia, Sydney.
23. Standards Australia, **AS 1482** *Electrical equipment for explosive atmospheres - protection by ventilation - type of protection*, Standards Australia, Sydney.
24. Standards Australia/Standards New Zealand, **AS/NZS 1715** *Selection, use and maintenance of respiratory protective devices*, Standards Australia, Sydney.
25. Standards Australia/Standards New Zealand, **AS/NZS 1716** *Respiratory protective devices*, Standards Australia Sydney.
26. Standards Australia, **AS 1940** *The storage and handling of flammable and combustible liquids* (“Flammable and Combustible Liquids Code”), Standards Australia, Sydney.
27. Standards Australia, **AS 2268** *Electrostatic paint and powder sprayguns for explosive atmospheres*, Standards Australia, Sydney.
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29. Standards Australia, **AS 2430** *Classification of hazardous areas*, Standards Australia, Sydney.
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31. Standards Australia, **AS 3000** *Electrical installations - buildings, structures and premises* (“National Wiring Rules”), Standards Australia, Sydney.
32. Standards Australia/Standards New Zealand, **AS/NZS 4114** *Spray painting booths*, Standards Australia, Sydney.

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