Spray Painting Guide for Employers and Operators

QUEENSLAND GOVERNMENT

Department of Employment, Training and Industrial Relations

WORKPLACE HEALTH & SAFETY

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PREFACE

Spray painting is used in a variety of industries and by a variety of workers. It is used to paint motor vehicles, buildings (inside and outside), structures, furniture, white goods, boats, ships, aircraft and machinery.

Concerns about the adverse health effects of spray painting increased in the late 1980s following evaluation by the International Agency for Research on Cancer. The Agency declared that there was sufficient evidence to show occupational exposure as a painter could be carcinogenic (cause cancer).

The *National Occupational Health and Safety Commission (NOHSC) Guidance Material for Spray Painting*, has been heavily relied on in the preparation of this guide, which has been developed in consultation with an industry reference group and with input from industry sectors and others involved in spray painting. The assistance of these people and organisations is gratefully acknowledged.

This guide supports the regulatory provisions under the *Workplace Health and Safety Regulation 1997* - part 13 (hazardous substances). Where a person is required to do something under the regulation, the word "must" is used in the guide.

This guide will help employers, self-employed people and workers involved in spray painting work to:

- meet their obligations under the *Workplace Health and Safety Act 1995* and its regulations
- prevent or minimise exposure to risks from spray painting by using a process of hazard identification, risk assessment, risk control and review.

It applies to all industries where spray painting is carried out, including:

- motor vehicle smash repair shops
- furniture manufacturers
- white goods manufacturers
- the construction industry, including houses, high rise buildings, bridges, etc
- vehicle manufacturers
- boat builders.

SPRAY PAINTING RISKS

Hazardous substances pose the major hazard in spray painting. Other hazards include:

- operating plant, such as spray painting guns, ventilation systems, hoses, compressors and booths
- fire and explosion
- electricity
- noise
- manual tasks
- confined spaces
- heat
- the workplace environment (including lighting and cleanliness).

Chapters 2 to 10 deal specifically with these hazards.

This is not an exclusive list of hazards in spray painting operations in every workplace. Employers and self-employed people need to identify and assess all health and safety risks in their workplaces, including non-standard applications.

MANAGING RISKS

Workplace health and safety should be part of normal management systems used to operate a business.

If the workplace and work activities are designed with health and safety in mind, then risks 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 workers' hearing will not be at risk.

The risk management process is explained in detail in Appendix A.

Remember also that spray painting can impact on the environment, particularly noise, odour and health effects on people. As a spray painter you have a duty under the *Environmental Protection Act 1994* to prevent or minimise harm to the environment. The Environmental Protection Agency, local authority and industry associations can help you meet this duty, (see Chapter 14).

2 HAZARDOUS SUBSTANCES

See:

- *Workplace Health and Safety Regulation 1997 – part 9 (hazardous substances at construction workplaces)* and *part 13 (hazardous substances)*
- *Advisory standard for hazardous substances*

WHAT ARE HAZARDOUS SUBSTANCES?

The spray painting processes involving hazardous substances include:

- preparation (including preparing surfaces, tinting, mixing and pouring paints)
- spray painting
- storage, clean-up and disposal.

The hazardous substances used include paints, solvents, powders, lacquers, paint removers, resins, adhesives, surface preparation products, rust converters and rust removers. Normally, substances can be identified as hazardous by their labels.

Also some work processes generate substances that can be harmful to a person's health if they are absorbed into the body, for example, dusts from sanding and grinding operations or fumes from welding. Because the health effects of these can be similar to those from hazardous substances, they should be identified and controlled using the guidance below.

Example of hazardous substances and the effect on health

Many products contain several hazardous substances, for example, two-pack epoxy coatings which may contain:

- ***organic solvents***

(such as butyl acetate aromatic solvents) – Short-term, uncontrolled exposure can cause headaches, dizziness, nausea and fatigue. If the exposure continues, the people being exposed can suffer neurological effects. Gross over-exposure to organic solvents can cause asphyxiation and death.

- ***epoxy resin***

Uncontrolled skin exposure can cause irritation and rashes. Continued exposure can lead to sensitisation of the skin.

- ***amines***

Uncontrolled short-term exposure to some amines, for example the vapours of diethylene triamine, can cause irritation of the nose, throat, eyes and skin. Long-term uncontrolled exposure can cause skin and respiratory sensitisation.

HEALTH EFFECTS OF HAZARDOUS SUBSTANCES

Potentially all workers engaged in spray painting, or working nearby, can be exposed to hazardous substances. If exposure is not adequately controlled, these substances can have serious health effects, including:

- occupational asthma
- allergic contact dermatitis
- lung cancer
- *painter's syndrome* – from long-term exposure to organic solvents, it affects the brain
- damage to the reproductive system
- kidney or liver damage.

Shorter-term effects can include:

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

Hazardous substances can enter the body through:

- inhaling toxic vapours and mists
- swallowing the substance
- absorbing irritants through the skin and eyes.

MANAGING RISKS FROM HAZARDOUS SUBSTANCES

A general risk management process is outlined in Appendix A.

Identifying hazardous substances

The main ways to identify hazardous substances are Material Safety Data Sheets (MSDS) and labels, so for all hazardous substances used at the workplace, the employer or self-employed person must:

- obtain, record and display MSDSs
- make sure containers are labelled.

Material Safety Data Sheets (MSDS) for hazardous substances

An MSDS contains information about a substance, including its identity, chemical properties, health hazards, and information for its safe use (see Appendix B). Requirements for MSDSs include:

- manufacturers or importers must determine which substances are hazardous and prepare MSDSs for those substances
- suppliers must provide a current MSDS

to an employer or self-employed person:

- when first supplying a substance
- when first supplying a substance after the MSDS is updated
- on request from an employer, self-employed person, worker or worker's representative.

Retailers do not have to provide an MSDS to purchasers at retail outlets. If a hazardous substance is bought from a retailer and the MSDS is not available, a copy can be obtained from the supplier, manufacturer or importer.

An employer or self-employed person must:

- obtain a current MSDS from the supplier for all hazardous substances supplied to the workplace
- keep a register containing a list of all hazardous substances used at the workplace and put copies of MSDSs in the register
- keep the MSDSs close to where substances are being used.

Workers who may be exposed to the substance and workplace health and safety representatives must have easy access to the MSDS.

An MSDS 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 guidance material for the preparation of material safety data sheets*, or when information is added to the MSDS. Any alterations or additions to an MSDS in these cases should be clearly marked to indicate they were not part of the original MSDS.

Labels on hazardous substance containers

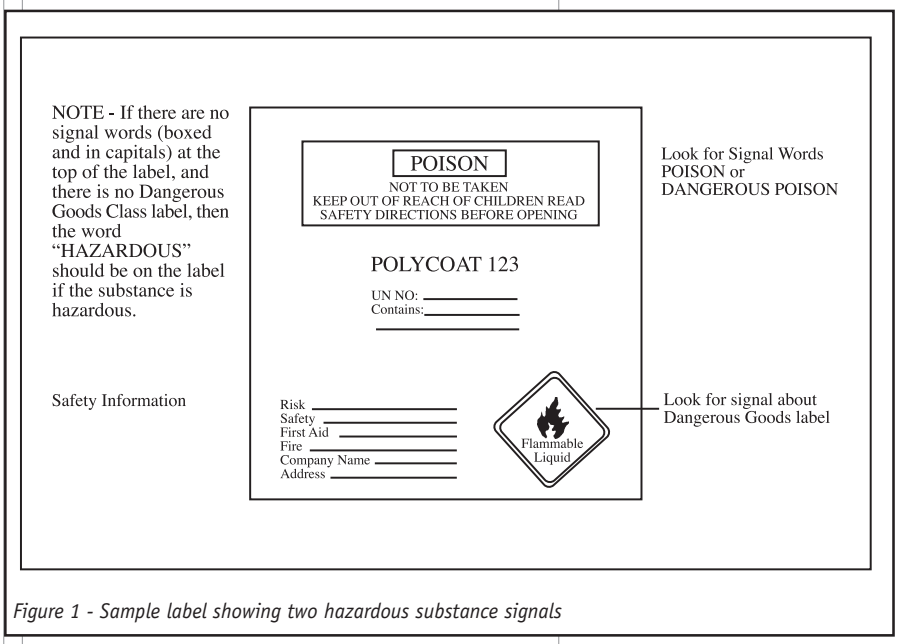


Figure 1 - Sample label showing two hazardous substance signals

Requirements for labelling hazardous substance containers include:

- suppliers of hazardous substances must ensure substances are correctly labelled
- employers or self-employed people must make sure the containers of all hazardous substances in the workplace are correctly labelled
- as labels can become unreadable through paint spillage or other damage, employers should instruct workers to:
  - read the label before opening a container
  - take reasonable care not to spill the contents
  - replace any labels that become unreadable.
- labels must not be interfered with, removed or altered
- label correctly any label found to be incorrect
- if the contents of the container are not known:
  - clearly mark the container with appropriate words, for example, "Caution do not use: unknown substance"

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.

Note:
Even small containers should be labelled. A tag can be used if it is to small for a label.

Risk and safety phrases are a guide to the type and seriousness of the harm a substance can cause. They appear as standardised information on labels, for example, "irritating to eyes", "explosive when dry", "do not empty into drains", "keep out of reach of children".

- store the container in isolation until its contents can be identified, and then appropriately label.

• 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, make sure the container into which it is decanted is labelled with the product name and the risk and safety phrases. If it is used immediately, no labelling is needed as long as the container is cleaned after use.

• if a hazardous substance is in an enclosed system, such as an airless spray system or recirculating paint system, an employer or self-employed person must warn workers and other people, for example, by appropriate signs.

Hazardous substances register

Employers and self-employed people must keep a register of all hazardous substances used at the workplace. The register must include:

- a list of the hazardous substances
- copies of their current MSDS.

The register must be kept up-to-date, for example:

- if a substance is introduced to the workplace, add it to the list and include a copy of its MSDS
- if an MSDS is revised, replace the earlier version with the new one.

Workers who may be exposed to a hazardous substance must have ready access to the register. It should also be available for inspection by workplace health and safety representatives, emergency services and the relevant public authorities.

Assessing risks from hazardous substances

A hazardous substances risk assessment must be done:

- as soon as possible after it is used
- within five years after the last assessment
- when a work practice involving the substance, process or plant is altered or relocated
- when new information about the substance, process or plant becomes available
- when health surveillance or monitoring shows that control measures need to be reviewed
- when new or improved control measures are implemented
- when a significant incident occurs.

A person doing an assessment should have sufficient knowledge and skills to evaluate the level of risk with hazardous substances. If necessary, professional assistance can be sought from an occupational hygienist, or other relevant specialist.

A practical way to carry out assessments follows.

Stage one – list the hazardous substances used in each job, task or work area, for example, paint, cleaning solvents, resins, thinners, surface preparation products, powders, adhesives, paint removers, rust converters, rust removers

Stage two – determine the nature and severity of the hazard by looking at labels and MSDSs. Substances can then be categorised as high, medium or low risk (see Appendix C)

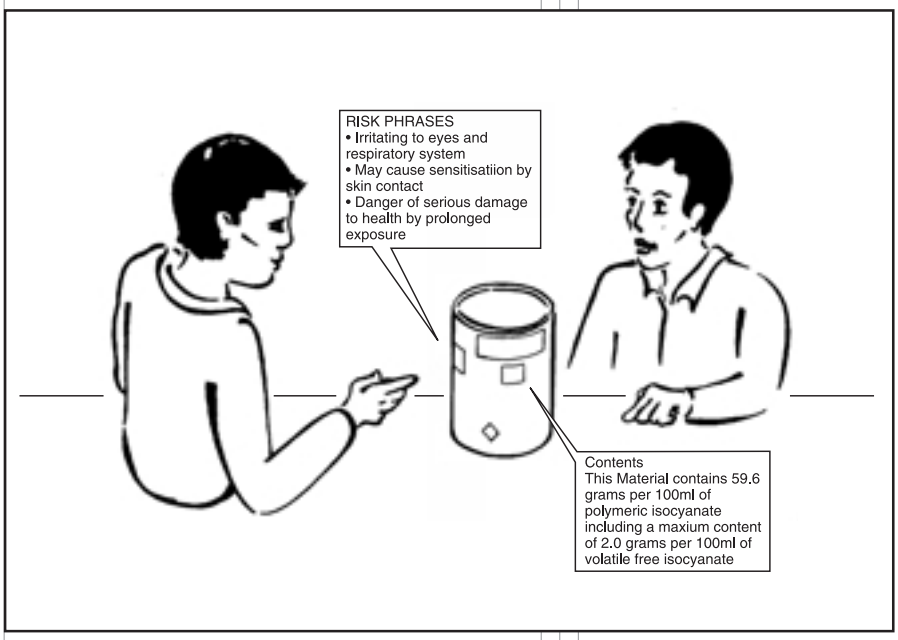


Figure 2 – Contents information and risk phrases can be found on the label

Stage three – inspect the workplace to find out whether people are being exposed to the substances being used. This involves:

- discussing work practices with workers
- determining whether substances are being released into the work area, for example, finding evidence of contamination such as dust, fumes, odours
- considering workers' symptoms of exposure such as ill health, injury and recurring irritations, for example, feelings of discomfort, respiratory problems, skin rashes – these may not seem serious at the time, but they can become long-term health effects
- considering everyone who could be potentially exposed, including people who pass through the area, such as cleaners and maintenance workers
- considering 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
- considering the combined effects of two or more hazardous substances
- estimating the degree of exposure for those potentially exposed
- considering existing control measures and making sure they are properly used, maintained and workers are trained in them
- considering the influence of the type of spray painting process on the risk.

Stage four – *evaluate the risks for each job, task or work area (see Appendix A)*

Generic assessments

One generic assessment can be done to cover different workplaces or work areas if:

- the same hazardous substance is used in similar ways in the different areas
- the same employer controls a number of similar workplaces

Organic solvents
Except for water (which is an inorganic solvent), most solvents used at work are organic. Organic solvents cover a broad range of different substances, for example toluene, xylene, methyl ethyl keton, acetone, benzene, ethylene glycol derivatives, turpentine and white spirit. Possible health effects vary though most of them are flammable. Do not assume that water-based products are not hazardous because many contain organic solvents or other hazardous substances.

Note: *Odour is not a reliable indicator. While odour can indicate a problem, the absence of odour does not mean there is no problem.*

Inhaling hazards in spray painting
Hazardous substances used in spray painting can be inhaled as soon as the container is opened. Many are volatile, that is, they evaporate quickly. The resulting vapours can then be inhaled. The spray painting process also converts substances to aerosol form. Aerosols are very small droplets of liquid in the air and can be inhaled.

Skills/training issues
The more waste there is in spray painting, the higher the risk from hazardous substances, vapours and aerosols. A skilled spray painter knows how to select and use equipment to get the best finish with the least waste: Consider:
- *the greater the spray distance, the greater the overspray*
- *increased air pressure creates more overspray*
- *selection of spray nozzles so that atomisation is no finer than necessary*
- *selection of the spray painting process to fit the job requirements without unnecessary overspray and bounce-back.*

Characteristics of the different processes:
- ***high volume-low pressure (HVLP) spray painting** – very high transfer efficiency; very little overspray; negligible bounce-back; high flow rate; no risk of injection injury*
- ***conventional compressed air (low pressure) spray painting** – extensive overspray; bounce-back in cavities and at corners (rebound); high sound levels*
- ***airless (high pressure) spray painting** – less overspray, bounce-back and aerosol than conventional air spraying; relatively high viscosity paints can be used (less solvent is needed in the paint); high flow rate and fast application; risk of injection injury; 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** (see Chapter 5) – spray guns heavier and more difficult to handle; static electricity*
- ***hot spraying** – uses very little thinner; reduced overspray; increased fire or explosion potential*
- ***pressure pots** – risks from over-pressurisation (pressure must be released before opening to refill); damaged vessels and incorrectly fitted hoses and couplings; awkward manual handling; more solvents used in maintenance.*

2 HAZARDOUS SUBSTANCES

Exposure standards

Exposure to hazardous substances **must not be greater** than the standards listed in the *National exposure standards for atmospheric contaminants in the occupational environment*. These do **not** represent levels at which every worker can be guaranteed protection, therefore:

- make sure exposure standards are not exceeded under any circumstances
- keep the level of exposure as low as possible
- plan to further reduce exposure in the future.

Air monitoring may be needed to determine whether the exposure standards are being exceeded, or approached.

Some hazardous substances in spray painting systems will not have declared exposure standards, for example, minor components in some paints. However, health effects may result from excessive exposure to these substances, so a person's exposure to these paint systems should be kept as low as possible.

Atmospheric monitoring

Monitoring involves regularly checking the level of exposure to a hazardous substance. Normally it is done by an occupational hygienist. Monitoring may be required:

- when the level of exposure is uncertain
- to help with the risk assessment process
- to test the effectiveness of the control measures
- as a review measure.

If monitoring shows that the level of contamination regularly approaches or exceeds the relevant exposure standard/s, the control measures should be re-assessed and adjustments made.

Monitoring results must be recorded and made available to workplace health and safety representatives and to workers who could be exposed to the hazardous substances involved. These workers must also be given a copy of the record.

Health surveillance

Health surveillance may also be necessary (see Chapter 13).

Records

Records of risk assessments, monitoring and health surveillance should be kept (see Appendix A).

Controlling risks from hazardous substances

Risks from hazardous substances must be controlled by preventing people's exposure or by reducing the exposure to as low a level as possible. The exposure must never be more than the relevant national exposure standard. Examples of control methods follow.

Elimination, for example:

- stop using particular hazardous substances
- use an alternative to spray painting.

Substitution, for example:

- replace a hazardous substance with a less hazardous one
- use a water-based paint instead of an organic solvent-based paint
- use the same substance in a less hazardous process, such as using HVLP spraying rather than airless spraying.

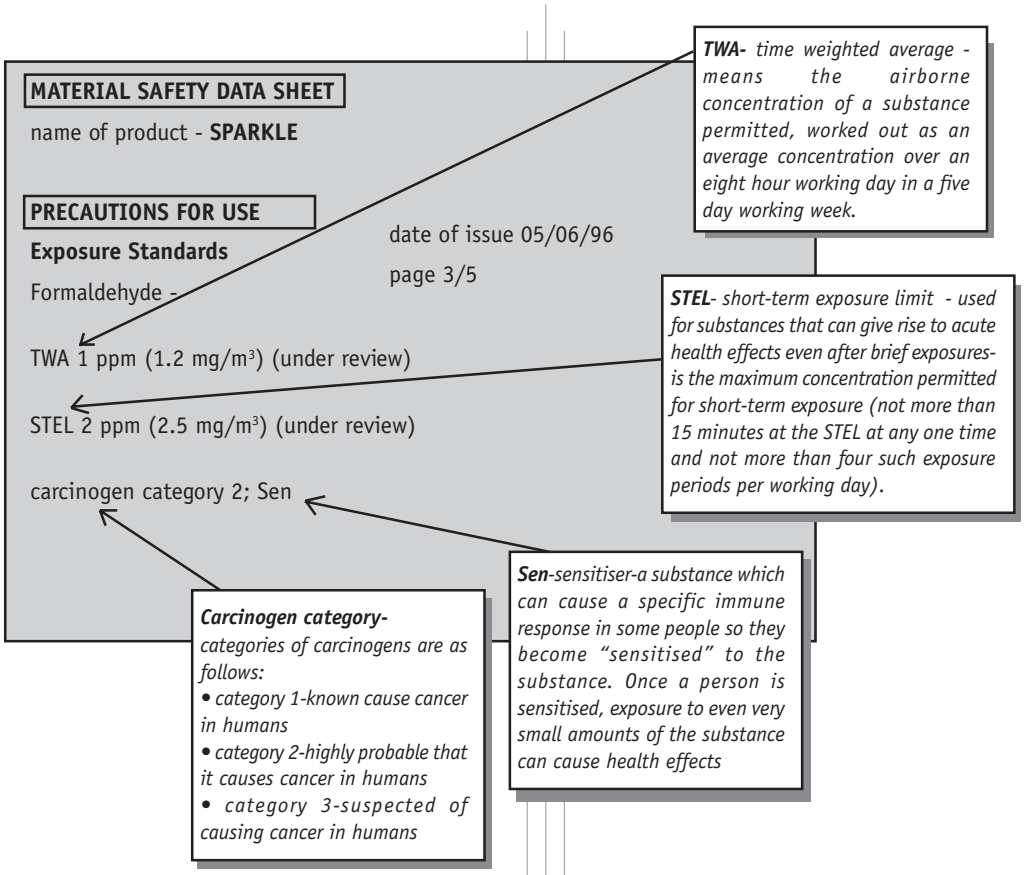


Figure 3 – Exposure standards information can be found in the "Precautions for Use" section of an MSDS

Isolation, for example:

- automate the process
- use spray booths as they effectively isolate other workers from the hazard (see Engineering controls)
- designate an area as a spray zone (see Appendix E).

Spray zones where a booth is not used

A spray zone with restrictions on entry can be designated around the spray painting area. This is the least effective form of isolation as it does not protect the spray painter. It does however isolate other people from the hazard.
Designating a spray zone – when setting the size of a spray zone and the time before re-entry is allowed, consider:

- the nature of the substances being sprayed
- the type of process being used
- the workplace environment, including wind speed, temperature and humidity
- the location of other people
- 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.

Controls for spray zones for hazardous substances include:

- physical barriers to keep unprotected people out of the spray zone
- restrict entry for unprotected people for an amount of time that ensures airborne concentrations of hazardous substances are below the exposure standards – work out the time during the risk assessment or through monitoring in the workplace
- remove any hazardous substances that

Note: Appendix E explains the use of spray zones when using different substance categories under different ventilation conditions. Spray zone distances should be determined after assessing all the risks and factors.

Minimum cleaning schedule for spray booths and associated equipment

Daily

• 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.

Weekly

• clean all surfaces that are subject to overspray to prevent build up of dried overspray which is a fire hazard

• inspect all fans and ducts in booths where air is filtered by being passed through an arrangement of metal baffles. Clean as necessary to prevent build-up of dried overspray.

Monthly

• inspect all fans and ducts in booths protected by filters or air washing devices and clean if necessary

• inspect all high pressure hoses.

Quarterly

•clean all fans and ducts.

are not immediately needed for spray painting work to reduce unnecessary exposure as well as fire or explosion risks

• temporary barriers using, for example, shadecloth or hessian to control overspray when painting large objects such as boats and bridges.

Engineering controls, for example:

• use high volume low pressure (HVLP) spray equipment

• use ventilation as the major engineering control to reduce exposure to vapours and aerosols. In order of effectiveness, use spray booths, local exhaust ventilation or dilution ventilation.

Spray booths, including:

- downdraft spray booth
- a semi downdraft spray booth
- end-draft booth
- an open-faced spray booth
- a tunnel or production booth.

A spray booth must be used when spray painting a hazardous substance, except when:

• it is not practical to do the painting in a booth, for example, painting a building, bridge or a large boat

• the painting involves minor work such as spotting or touch-ups, for example, painting a scratch or stone chip on a car, (painting a car panel with two-pack polyurethane paint would not be regarded as minor work).

Employers and self-employed people must make sure that:

• booths prevent or reduce as much as possible the escape of a hazardous substance. They must be fitted with a ventilation system incorporating a filtration system for removing airborne residue and an exhaust capture system

• ventilation systems are capable of producing a minimum air movement of:

- 0.3 m/s for a full downdraft booth
- 0.4 m/s for electrostatic spraying
- 0.5 m/s for any other booth.

• booths are inspected at regular intervals and properly maintained.

Manufacturers and importers must make sure booths effectively control hazardous substances and are fitted with effective ventilation, filtration and exhaust capture systems. Suppliers must give the purchaser of a booth information including:

• the use for which it is designed and tested

• maintenance procedures

• how to use it safely.

Booths should be designed, constructed, installed and maintained to comply with the Australian Standard, *AS/NZS 4114.1 – Spray painting booths* – [*part 1: design, construction and testing,* and *part 2: selection, installation and maintenance*]. A competent person should be consulted about the choice of a spray booth.

• **Local exhaust ventilation** systems capture the overspray and solvent vapour as close to the source of release as possible by drawing the contaminants into a capture hood. They should be fitted with a particulate filtration system to filter overspray. Wherever possible, local exhaust ventilation should be used when a spray booth cannot be used. It may be necessary to use it in combination with other control measures.

Information on local exhaust ventilation designed for hazardous areas is given in *AS 1482 – Electrical equipment for explosive atmospheres – protection by ventilation – type of protection v*. Advice on selection of an appropriate system should be sought from a competent person.

• **Dilution ventilation** dilutes and displaces contaminated air with fresh air which is supplied to the work area by mechanical supply fans or natural air currents through doors, windows or other openings in the building. Systems should comply with *AS 1482 – Electrical equipment for explosive atmospheres – protection by ventilation – type of protection v*. It can be used to supplement local exhaust ventilation which may not be fully effective. Using both types of ventilation together can be an acceptable way to control hazardous substances and fire risks when a spray booth is not practical. However, other controls are needed to make sure exposure standards are not exceeded. When using dilution ventilation:

  • put the exhaust openings as close as possible to the spray painting operation
  • place the exhaust openings and the inlet air supply so that the incoming air supply passes through the spray zone
  • the spray painting operator should stay between the air inlet supply and the source of vapours or aerosols generated
  • temporary barriers may be needed to channel the dilution ventilation through the spray zone and to restrict cross currents
  • make sure the contaminated exhaust air does not re-enter the work area
  • use auxiliary mixing fans to disperse the spray painting emissions towards the outlet and to enhance the rate of air dilution.

Administrative controls, for example:

• store solvents in covered containers with taps to avoid the need for pouring
• with surface preparation:
  • use wet sanding or rubbing where possible
  • avoid dry sanding unless dust extraction equipment is used
  • do not clean surfaces with rust/corrosion treatments unless there is adequate ventilation.
• mix and pour in a room clearly designated and used exclusively for it with good mechanical or natural ventilation and no ignition sources
• with spray painting operations:
  • avoid positioning the spray painter between the object being painted and the exhaust. An object can be sprayed on all sides by:
  • rotating the object on a turntable or revolving hook
  • using in-line spray booths
  • using down-draught booths.
• when using a down-draught booth do **not** spray above head height – use ramps, extension poles or powered lift platforms to do this
• keep unnecessary equipment out of booths, especially open fronted booths
• with emergency procedures:
  • when planning, look at information on MSDSs and labels
  • have personal protective equipment (PPE) available for people finding and repairing leaks or spills
  • exclude anybody unconnected with the emergency from the contaminated area
  • have copies strategically located throughout the workplace and train all workers
  • for significant spills, ensure containment, immediate clean-up and safe disposal of the substance.
• for minor spills, immediately clean up
• remove contaminated clothing immediately and clean the skin thoroughly with water and a water-based cleanser if hazardous substances are splashed onto clothing or body – do not use organic solvents or thinners to clean the skin as most can be absorbed through the skin into the body
• wash contaminated clothing before re-use
• have handwashing facilities available and make sure workers remove any PPE and wash their hands and face before eating, drinking, smoking and at the end of the day's work

Note: Sanding of polyurethane paints that are not fully cured generates dust containing unreacted isocyanate.

• give workers who may be exposed to hazardous substances an induction and on-going training about the substances (see Chapter 12).

Personal protective equipment,
(see Chapter 11 and Appendix F),
for example:

- use PPE in conjunction with other control measures
- provide workers with suitable PPE that is clean, functional and fitted properly
- instruct workers on using PPE.

Monitoring and reviewing controls

Control measures should be:

- regularly monitored and reviewed to make sure they stay effective and do not create new risks
- reviewed if work-related ill health or injury is reported
- reviewed to identify any new hazards if there is a change to the work processes or substances.

Influence on risk from the object being sprayed

The object being sprayed can influence risk. Consider:

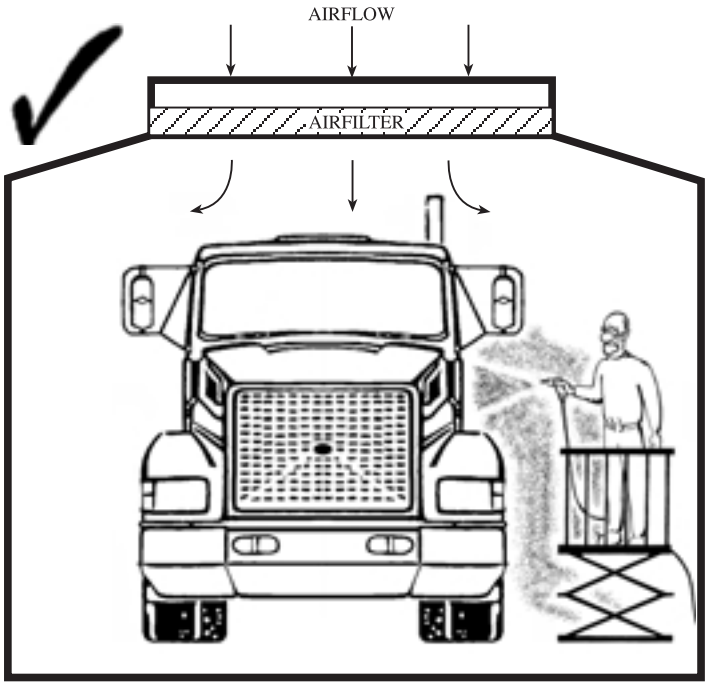
- *the position of the object in relation to the painter*
- *the positioning of other workers*
- *the direction of the stream of ventilating air*
- *the size and shape of the object*
- *the ease of moving the object.*

Avoid positioning the object so that painters have to spray towards each other, towards other workers or up wind of other workers. (See example illustrations on pages ? and ?.)

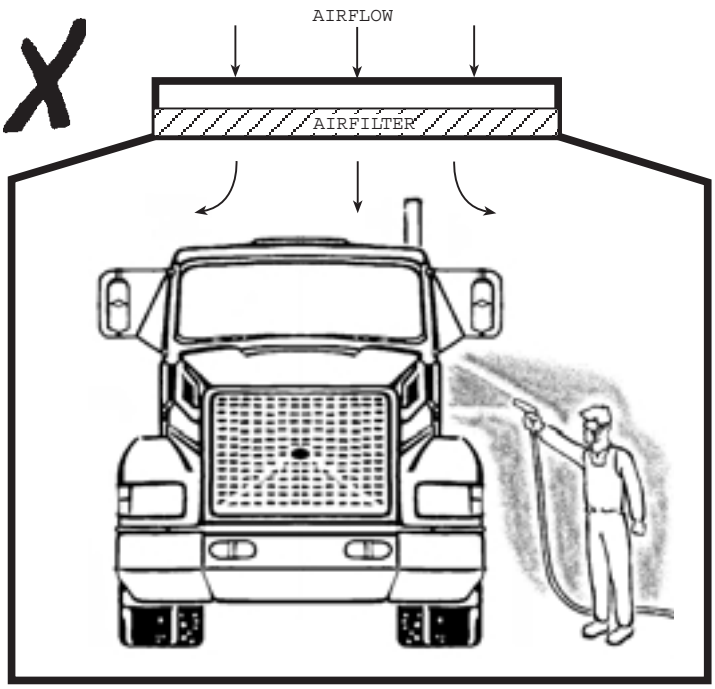
Where respiratory protective equipment is used:

- *operators should be clean-shaven to ensure an adequate face seal*
- *cartridges should be dated and changed regularly*
- *airline filters should be changed as required*

EXAMPLES OF WORKING PRACTICES 2



The use of a gantry or lift avoids overspray of the operator and problems caused by stretching and reaching.



The operator is exposed t
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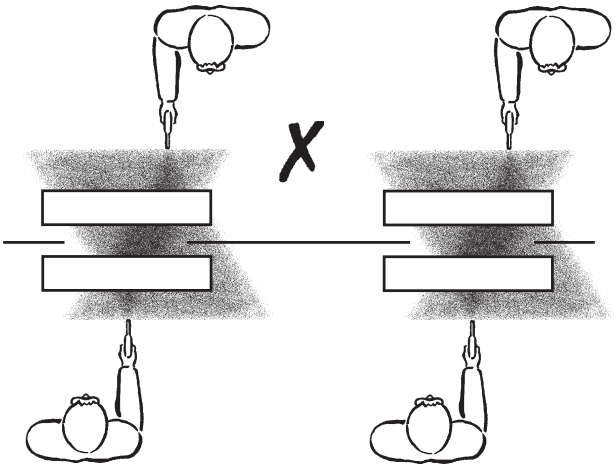
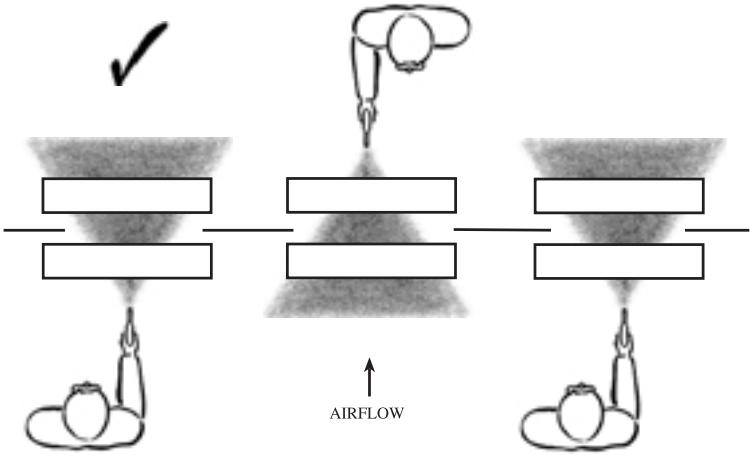
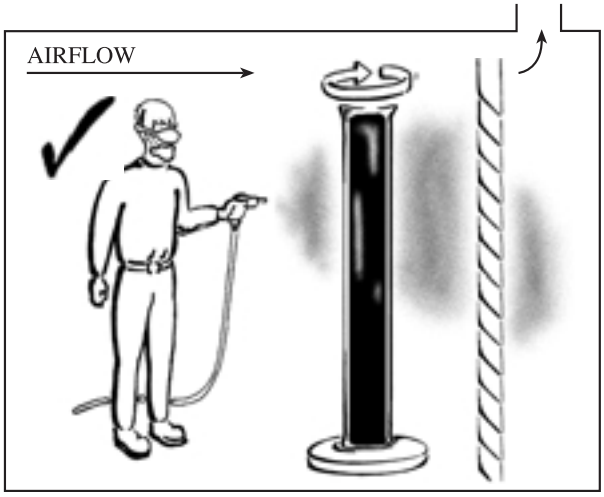


Each operator is exposed to overspray because of their placement opposite each other

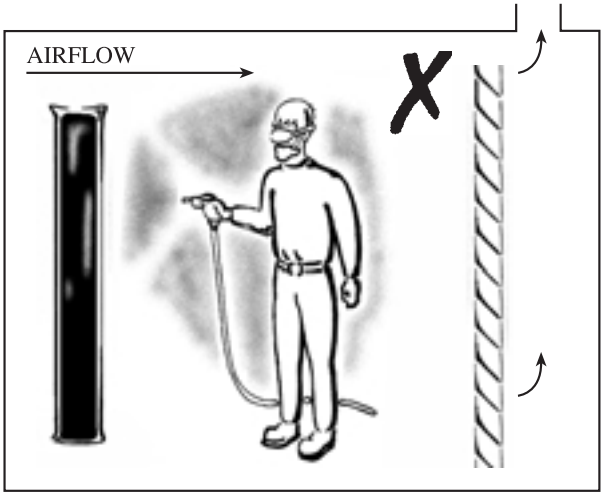


The use of staggered work positions avoids overspray of the operators.

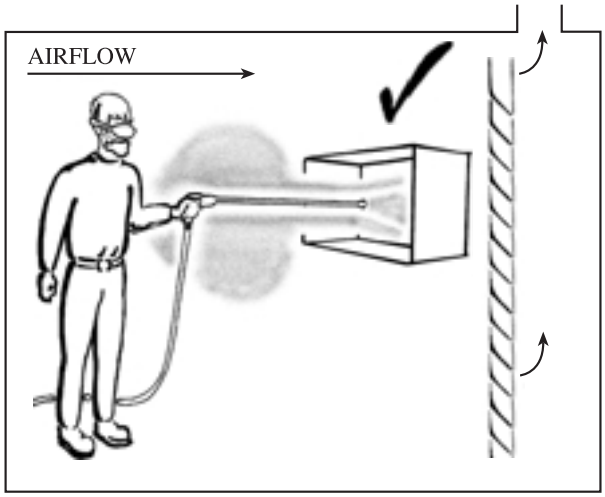
2 EXAMPLES OF WORKING PRACTICES



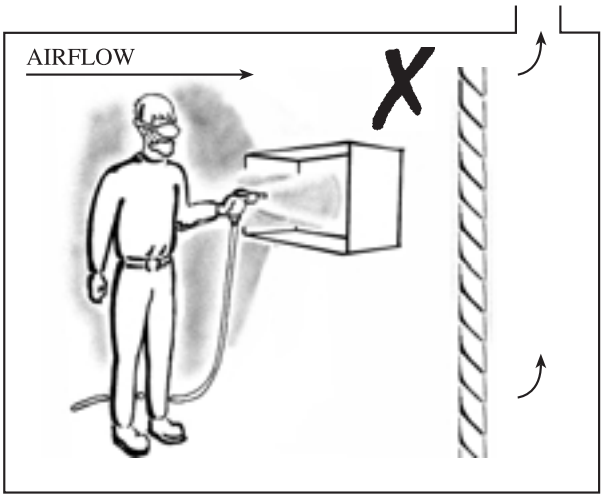
To avoid overspray, the article should be rotated rather than operator spraying against airflow



The operator is exposed to overspray because of poor positioning to the airflow



Spraying with “long” nozzle avoids overspray of operator



The operator is exposed to overspray

See:

• *Advisory standard for plant*.

WHAT IS PLANT?

Plant includes machinery, tools, appliances and equipment, for example:

- spray painting guns
- spray booths
- pumps
- ventilation systems
- compressors
- hoses
- personal protective equipment.

YOUR RIGHT TO INFORMATION

Manufacturers and importers must make sure that plant is safe when used properly. Manufacturers, importers and suppliers must also make sure that appropriate information about the safe use of plant is available. In the case of a spray painting booth, the supplier must provide this information to the purchaser, together with the maintenance procedures.

Employers and self-employed people should make sure that they receive this information about any plant they obtain for use at their workplace.

PLANT HAZARDS

Plant hazards include:

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

MANAGING RISKS FROM PLANT

Appendix A outlines a general risk management process.

Identifying risks from plant

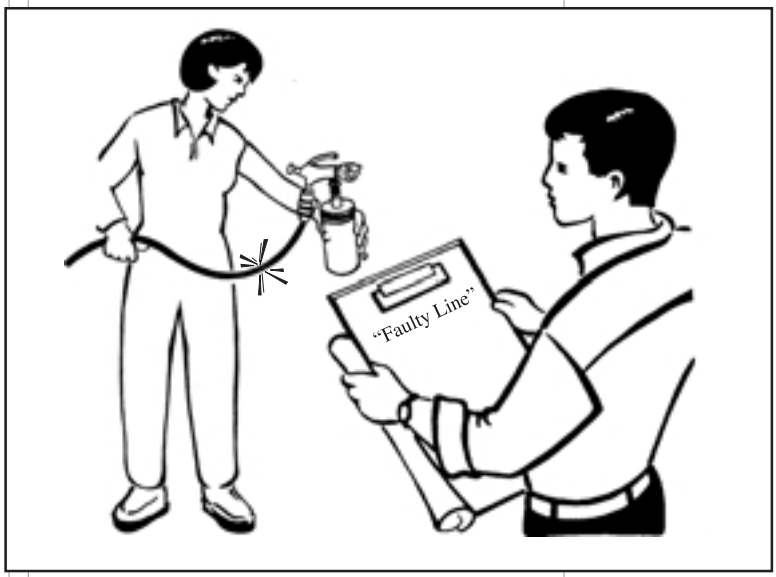
When identifying plant risks, consider whether anyone could be harmed:

- by operating the plant
- by otherwise coming into contact with the plant.

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

- introducing and installing new plant
- modifying existing plant
- using the same plant in a different way or place
- using the plant in unusual circumstances
- new health and safety information about the plant becomes available, for example, from trade journals, employer associations or the Division of Workplace Health and Safety.

Figure 4 – Identifying plant hazards – inspection of empty spray apparatus shows there is a hole in the supply line



3 SPRAY PAINTING PLANT

Assessing risks from plant

A risk assessment should take into account:
- systems of work associated with plant
- the layout and condition of the work environment where the plant is used
- the capability, skill and experience of the people normally using the plant
- reasonably foreseeable abnormal conditions
- whether the plant is:
  - suitable and safe for the job it is doing
  - used according to the manufacturer's instructions
  - in good condition and well-maintained
  - safely and suitably located.

When assessing the level of risk, look at issues such as:
- the plant and its parts
- the environment in which the plant operates
- testing or technical evaluation of items such as compressor gauges, air flows and gas emissions
- information and advice from designers, manufacturers, suppliers, importers
- injury, ill health and near-miss records
- operator training
- operating and maintenance procedures
- purchasing procedure that considers plant risks, for example, noise.

Where multiple items of plant of the same design are installed and used under conditions that are basically the same, the risk assessment can be carried out on a representative sample.

Controls for specific issues:
- ***Injection injury*** *can be a particular risk when using high pressure airless spray painting equipment. A substance can be injected into the bloodstreem that can cause a lack of blood supply to the area or chemical or thermal burns. In some cases this can result in the amputation of fingers or hands. To avoid injury:*
  - *never clean airless spray guns by covering the nozzle with a cloth or material held in the hand*
  - *always put the safety catch on to prevent the spray gun trigger being accidentally pulled during stoppages in work or when the spray tip is being changed*
  - *make sure operators never point the spray gun at themselves or any other person and fingers and hands are kept away from the spray jet*
  - *do not remove the tip guard.*
- ***high pressure hoses and lines*** *should be located and designed to ensure:*
  - *they are protected from rupture*
  - *flammable material is not discharged into an area where there is a source of ignition in the event of a leak or rupture*
  - *hoses are the minimum length required*
  - *hoses and lines are regularly inspected and maintained.*

Controlling risks from plant

Elimination, for example:
- remove an item of plant that was assessed as a risk.

Substitution, for example:
- use a pneumatic sander rather than an electrical one
- use an HVLP spray gun instead of a conventional compressed air one for touch-ups.

Isolation, for example:
- put up a barrier to separate people from the plant.

Engineering controls, for example:
- optimise ventilation (see Chapter 2).

Administrative controls, for example:
- make sure purchasing specifications for new equipment cover all safety features
- regularly carry out routine and preventive maintenance
- keep plant maintenance records and schedules
- train workers in the safe operation and maintenance of plant
- consider workload and fatigue factors when developing staff rosters
- make sure information on emergency stops/guards for plant are clearly displayed
- clean airless spray guns according to manufacturers' instructions.

Personal protective equipment (see Chapter 11 and Appendix F).

Monitoring and reviewing measures

- control measures should be monitored and reviewed regularly to make sure they stay effective and do not create new risk.

FIRE AND EXPLOSION CAUSES

Many paints contain flammable substances and spray painting mists spread and rapidly fill airspace, creating the risk of fire and explosion if they come into contact with any source of ignition, such as open flames, static electricity or sparks.

MANAGING RISKS OF FIRE AND EXPLOSION

Appendix A outlines a general risk management process.

Identifying and assessing fire and explosion risks

Possible sources of ignition include:

- lit cigarettes, pipes and cigars
- equipment that produces sparks, such as abrasive grinding wheels
- combustion motors
- 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
- portable electrical equipment, including mobile phones.

Other fire hazards include:

- incorrectly stored flammable materials
- a build-up of paint residue in work areas or on equipment as it may be flammable
- paint and solvent soaked rags
- electrical equipment or installations in spray painting and paint mixing areas – these should comply with *AS 2381.1 – Electrical equipment for explosive atmospheres – selection, installation and maintenance – part 1: general requirements*.

Controlling risks

Isolation controls, for example:

- establish a spray zone (see Chapter 2 and Appendix E). Put up warning signs restricting entry designed according to *AS 1319 Safety signs for the occupational environment*, such as, "SPRAY ZONE: UNAUTHORISED PEOPLE KEEP OUT. NO SMOKING, WELDING, GRINDING, NAKED FLAMES OR OTHER SOURCES OF IGNITION".

Engineering controls, for example:

- optimise ventilation (see Chapter 2).

Administrative controls, for example:

- mix and pour in a room clearly designated and used exclusively for it with good mechanical or natural ventilation and no ignition sources
- before pouring flammable liquids from one container into another, set both containers down on an earthed surface then bring the containers into contact before pouring and keep them in contact while pouring (preferably connect them with alligator clips – see Figure 5)
- where containers have air lines, always replace the plugs as soon as the air lines are disconnected
- leave empty drums or cans in a safe place with their lids off until the vapour has dissipated or rinse with water to neutralise the vapour
- provide suitable fire extinguishers and train workers in their use

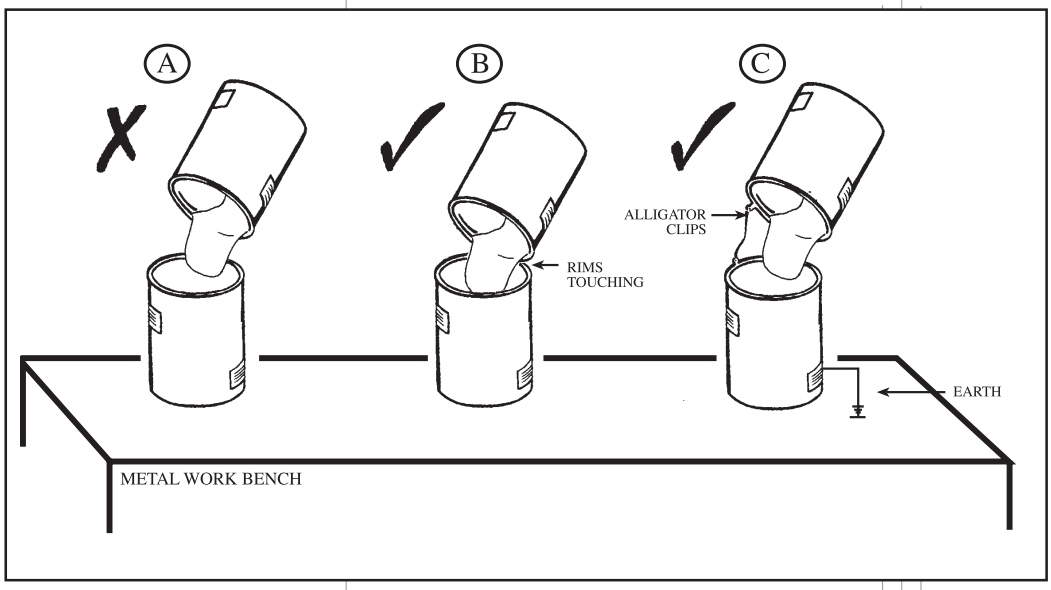


Figure 5 - Pouring flammable liquids from one container into another

- store and handle flammable or combustible liquids in accordance with *AS 1940 – The storage and handling of flammable and combustible liquids*, for example:
  - store paints in containers with lids
  - store solvents in covered containers with taps to avoid the need for pouring
  - always return unused liquid to a container labelled for that liquid
  - solvent soaked rags should be stored wet and safely contained after use or removed from the workshop
  - store flammable materials including unused liquid in tightly closed containers that are correctly labelled
  - replace lids of containers after each use
  - keep supplies of paints and solvents not in use that day in a separate store room or storage cabinet
  - do not leave containers of flammable liquid near any heat source or source of ignition or in direct sunlight
  - place warning signs on storage cabinets and outside storage areas
- where spray guns are gravity fed, containers should not exceed 45 litres in capacity and should be suspended firmly by non-combustible material
- clean up paint and solvent spills quickly.

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 drips and lessen the subsequent evaporation.*

Consult the Queensland Fire and Rescue Authority for advice on:

- *emergency planning*
- *suitable fire extinguishers and where to put them*
- *other requirements for fire safety such as a hazardous materials register.*

See:

• *Workplace Health and Safety Regulation 1997 – part 16 (electrical equipment and installation)*.

HEALTH RISKS

Electricity used in spray painting poses unique health risks including:

• electrocution from direct or indirect contact with electricity

• burns – flashes and arcing due to short-circuiting may lead to severe tissue burns or the ignition of flammable gases.

MANAGING RISKS FROM ELECTRICITY

Appendix A outlines a general risk management process.

Electrical installations should comply with *AS 3000 – Electrical installations – buildings, structures and premises* (known as the *SAA wiring rules*) which outlines the standards for wiring.

Operating electrical equipment that is damaged or not designed to give explosion protection in spray painting and paint mixing areas creates an immediate risk.

Static electricity charges can be generated in any spray painting process if two differently charged materials come into contact. It can be generated by:

• touching two metal cans together during decanting

• clothing or synthetic fibres prone to accumulation of static charge including nylon, pure wool, wool blends (unless treated) and non-conducting footwear

• liquid flowing in pipes or vessels

• airless spray painting using high fluid pressure (control this by electrically earthing the airless spray gun and any conductive article that is being sprayed including a container that the flow from the gun is directed into).

Other risks are posed by wet work, for example, wet rubbing and electrostatic spray painting.

Information on methods of bonding, dissipating charge from installations, and electrical isolation to prevent static discharge is in *AS 1020 – The control of undesirable static electricity*. All electrical equipment in a spray painting workshop including mixing and storage areas should comply with *AS 2381.1-Electrical equipment for explosive atmospheres – selection, installation and maintenance – general requirements*.

ELECTROSTATIC SPRAY PAINTING CONTROLS

General

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. However there is a risk of electric spark ignition both at the spray gun nozzle and at the wetted surface of the workpiece.

This equipment should only be operated by trained personnel who understand the safety precautions described below and in *AS 2268 – Electrostatic paint and powder spray guns for explosive atmospheres*.

Spray zones/booths

Electrostatic spraying should be carried out in a spray zone exclusively reserved for that work (see Chapter 2 and Appendix E). The floor of the spray zone should be made of electrically-conducting material and it should be earthed.

The exhaust system must provide an air movement of at least 0.4 metres/second at the spray position. The direction of the flow of air should be from the operator towards the workpiece. Higher extraction rates may be

needed for more hazardous vapours. The point of extraction should be at a low level preferably.

Installation

Only the spray gun and the cables connected to it should be in the spray zone. Put all other electrical equipment outside the zone or enclose it separately in a fire-resistant structure unless the equipment is suitably certified for use in an area in which an explosive atmosphere may be present.

Earthing of equipment

All equipment and metal surfaces within three metres of the charged head of the spray gun should be earthed. This includes:

- the floor of the spray zone – this should be of a material that is electrically conducting to the earthing of the spray gun (clean any overspray from the floor to avoid build-up of an insulating layer)
- 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
- each workpiece - regularly clean earthing hooks to avoid build-up of an insulating layer.

Other earthing methods include:
• frequent contact with an earthed metal object
• a metal wrist strap connected to earth by a flexible lead.
But consider:
• the danger of electric shock from mains supply
• the possible need for quick evacuation from a dangerous area
• psychological effects
• the person's work movements.

Earthing of personnel

Clothing other than footwear

People in the spray zone who could receive a charge while working should **not** wear:

- metal articles, such as metal watches
- silk or synthetic fibres (or other non-conductive materials) that can generate and accumulate static electricity unless regularly treated with an antistatic solution
- insulating gloves (insulating gloves with the palms cut out **can** be used).

Note: *Commercially available antistatic solutions make fibres conductive, but are only effective for short periods. Therefore apply them at regular intervals (at least after every wash).*

Footwear

Antistatic or conductive footwear is recommended to stop the build-up of electrostatic charge in a person. Antistatic footwear must have a resistance of:

- not greater than 10×10^7 ohms
- not less than 7.5×10^4 ohms.

Leather-soled footwear may not always stop static build-up. But any type of footwear can be worn if a conductive garter is used. Strap onto the skin of the wearer's leg and make electrical contact between it and a large area on the sole of the footwear.

Be careful of footwear that is ageing or has paint, oil or wax on the sole as it can make the foot wear nonconductive or allow electrostatic charges to build up. The resistance of footwear should be regularly tested. Also, socks should not be made from silk or synthetic fibres unless treated with an anti static solution.

Handling of paint and cleaning solvent

- do not allow drums of paint or cleaning solvent in the spray zone while spraying
- the cleaning solvent should have a flashpoint of not less than 23°C and preferably above the room temperature
- use only a metal solvent container that is efficiently earthed
- do not clean the spray gun with the high voltage supply switched on.

See:

- *Advisory standard for manual handling*
- *Advisory standard for work involving repetition, force or awkward postures*
- *Advisory standard for manual handling in the building industry*.

MANUAL TASKS IN SPRAY PAINTING

Manual tasks are tasks where a person has to grasp, manipulate, carry, lift, lower, push, pull, hold or restrain something. Injuries from manual tasks are usually caused by ongoing wear and tear and damage to the body. They are almost always due to repeated or continuous use of the same body parts that lead to inflammation and tissue injury. They are rarely caused by a one-off overload situation.

Strains and sprains are the most common injury. The most injured body parts are the back and the shoulders. Damage can gradually build up through:

- manual handling, for example, moving vehicles, cartons, equipment
- staying in a fixed posture for a long time, for example, holding the spray painting gun above shoulder height for a long period
- repetitive work with the hand and arms, for example, polishing a car or wet-sanding an object
- gripping and moving heavy or vibrating tools
- pushing or pulling, especially when also twisting, such as moving compressors, pressure pots.

CONTROLLING RISKS FROM MANUAL TASKS

Appendix A outlines a general risk management process.

Design controls offer the best solutions because they are permanent and can best prevent or reduce the risk. They include:

- **job design**, for example:
  - put all frequently used items within easy reach
  - store heavy items between thigh and shoulder level
  - use stable, adjustable work platforms to raise workers, so they do not have to perform tasks with raised arms.
- **devices**, for example:
  - mobile winches for lifting heavy articles
  - mobile or overhead cranes/hoists
  - trolleys, pallet jacks for moving heavy articles
  - manually or electrically operated forklifts or work platforms
  - height adjustable stools
  - body trolleys.

Administrative controls can reduce the risk by decreasing the time a worker is exposed. They include:

- **work organisation**, for example:
  - rotate workers to reduce the time spent doing one task, or alternate tasks between repetitive and non-repetitive work
  - reduce duration of work with prolonged stooping or bending
  - consider workload and fatigue factors when developing staff rosters
  - rearrange the flow of materials at the worksite to make sure there is a smooth supply of material and to reduce double handling
  - use team lifting when moving heavy or bulky articles.
- **rest breaks** – help prevent tissue damage by having workers take micro breaks (a few seconds) regularly during repetitive work or work with sustained postures to change body position and stretch
- **training**
- **housekeeping** - make sure walkways and floor areas are clear, especially when moving heavy or bulky loads.

Personal protective equipment, (see Chapter 11 and Appendix F), should be used to supplement other controls where necessary, for example:

- kneepads for kneeling work
- gloves, particularly for use with vibrating tools, though it should be noted that gloves reduce the strength of a worker's grip on an object and can increase risk
- safety boots.

7 CONFINED SPACES

See:

• *Workplace Health and Safety Regulation 1997 – part 15 (confined spaces)*.

CONFINED SPACE HAZARDS

A confined space is an enclosed or partially enclosed space that:

- is not intended or designed primarily as a place of work
- may have restricted entry and exit
- is at atmospheric pressure
- may have the potential for engulfment, inadequate ventilation, a contaminated atmosphere or an oxygen-deficient atmosphere.

The main hazards found in confined spaces are:

- lack of oxygen
- toxic or flammable gases, vapours or fumes
- engulfment
- mechanical equipment.

HEALTH RISKS

The health risks associated with working in confined spaces include:

- burns
- electrocution
- suffocation and asphyxiation
- poisoning
- brain damage and death
- crush injuries.

CONTROLLING RISKS FROM CONFINED SPACES

Appendix A outlines a general risk management process.

A worker whose upper body or head is within a confined space is considered to have entered the confined space.

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

All work in confined spaces should be carried out in accordance with *AS 2865 – Safe working in a confined space*. The main requirements are:

- the use of atmospheric monitoring
- the presence of a trained stand-by observer
- the use of safety harnesses
- rescue equipment.

Elimination, for example:

- remove object to be painted from the space.

Engineering controls, for example:

- use mechanical ventilation systems to remove hazardous contaminants produced by the spray painting work
- use non-sparking tools where there is a flammable atmosphere.

Administrative controls, for example:

- develop a method for working in confined spaces. This should cover:
  - **before entry**, including:
  - emergency entry and exit
  - first aid
  - lockout
  - rescue
  - fire protection
  - communications
  - worker selection
  - worker training
  - defining responsibilities.
  - **at the time of entry**, including:
  - isolation of the confined space
  - signs, barricades and rescue equipment at the entrances

- testing and recording of the atmosphere
- appropriate PPE
- sufficient lighting and visibility.

• **while work is being undertaken in the confined space**, including:

- continuous or periodic monitoring of the atmosphere
- implementation of safe work practices.

• **after work has been completed**, including:

- confirmation that all people and equipment are accounted for
- review of the operation (including unsatisfactory aspects).

Personal protective equipment, (see Chapter 11 and Appendix F), for example:

• only allow people equipped with suitable PPE (including air-supplied respiratory protective equipment, safety harnesses and lines) to enter the confined space when it is not practical to provide a safe oxygen level, or the airborne contaminants cannot be reduced to safe levels

• protect the breathing line to the respirator when air-supplied respiratory devices are required.

8 NOISE

See:

- *Workplace Health and Safety Regulation 1997 – part 10 (noise)*
- *Advisory standard for noise.*

Employers must prevent risk to their workers from exposure to excessive noise which is noise above 85dB(A), as an average level, over an eight hour day. Over 10 hours, this is equivalent to 84dB(A), and over 12 hours, 83dB(A). Risk from noise is affected by:

- intensity (loudness) and the frequency (pitch) of the noise
- duration and pattern of exposure
- a person's susceptibility to hearing impairment.

Effects include:

- temporary threshold shift – occurs immediately after exposure to high noise levels and may last for minutes to hours
- noise induced hearing loss – occurs from long-term exposure to high noise levels
- tinnitus – ringing in the ears
- acoustic trauma – from explosions or extremely loud impulses.

It can also affect concentration, lead to incorrect decisions being made, make communication difficult and make it hard to hear emergency signals.

Sources of noise in spray painting can include:

- workshop operations
- vehicles
- plant and equipment
- ventilation systems.

Typical noise levels of plant and work practices used in spray painting range between about 82 and 110dB(A). Typical noise sources at operator ear level are:

• sander (air* or electric)	82 – 100 dB(A)
• nine inch angle grinder	97 – 110 dB(A)
• air compressor	85 – 89 dB(A)
• inside a spray booth	75 – 91 dB(A)
• processes involving compressed air*	93–110 dB(A)

**This is mainly high frequency noise which has greater potential for causing hearing damage.*

CONTROLLING NOISE RISKS

Appendix A outlines a general risk management process.

Elimination, for example:

- replace noisy plant with other, quieter plant.

Substitution, for example:

- substitute a noisy process with a quieter one, such as using vacuum cleaning rather than compressed air for cleaning surfaces.

Isolation, for example:

- put a permanent or temporary acoustic enclosure around a compressor or noisy activity
- mount noisy equipment on vibration isolating platforms or rubber mats.

Engineering controls, for example:

- choose an appropriate nozzle that will reduce compressed air noise.

Administrative controls, for example:

- purchase equipment with noise reduction incorporated into its design
- carry out noisy processes out of normal working hours taking account of local authority noise requirements
- use job rotation so workers are not constantly exposed to excessive noise
- keep plant and equipment maintained
- train workers in safe work practices and the use and maintenance of personal protective equipment.

Personal protective equipment, (see Chapter 11 and Appendix F), for example:

- use personal hearing protectors such as ear plugs, ear muffs and hearing protective helmets that have passed the physical tests specified in *AS 1270-Acoustics – hearing protectors*.

HEAT RISKS IN SPRAY PAINTING

In spray painting, the main work factors leading to heat stress are:

- air temperature
- relative humidity
- air movement
- radiant temperature
- worker's clothing
- physical activity of the worker
- personal protective equipment required to be worn.

Heat stress occurs when the body cannot lose heat fast enough. Health effects include:

- discomfort
- irritability
- dehydration
- reduced concentration
- heat rash
- heat cramps
- heat exhaustion
- heat stroke.

Workers who are more susceptible to heat stress include those who are:

- unacclimatised to workplace heat levels
- physically unfit
- overweight
- elderly
- wearing inappropriate clothing
- suffering from heart, circulatory or skin disorders
- dehydrated
- using medications that change temperature regulation or perspiration.

CONTROLLING RISKS FROM HEAT

Appendix A outlines a general risk management process.

Some personal protective equipment that is used in spray painting work, such as helmets and protective suits, can lead to heat stress, especially as it is often worn for long periods of time and in hot conditions. The effects can be reduced by:

- limiting the time an operator works continuously, for example, job rotation
- frequently taking short breaks and drinking cool water
- shading an outdoor work area from the sun or scheduling work to a time when temperatures are cooler
- using cooling devices fitted to the air supply of helmets
- wearing cotton garments underneath PPE where appropriate.

10 WORKPLACE ENVIRONMENT

See:

- *Workplace Health and Safety Regulation 1995 – part 8 (Amenities)*
- *Advisory standard for workplace amenities.*

Workplace environment factors to consider include:

- lighting
- cleanliness
- storage
- the possibility of slips and trips
- working at heights
- temperature
- first aid
- the availability and location of amenities.

CONTROLLING RISKS FROM WORKPLACE ENVIRONMENT

Appendix A outlines a general risk management process.

Cleanliness, for example:

- clean residue build-up on walls, floors and work surfaces frequently
- clean up sanding or grinding dusts with damp rags, wet vacuum cleaners or other wet-cleaning equipment
- keep the workshop clean and tidy, such as through the efficient use of storage, to reduce slips, trips and falls.

Amenities, for example:

- physically locate washing, changing and meal areas away from hazards and keep them clean and well-maintained.

Ergonomic design, for example:

- keep walls and work surfaces as smooth as possible so they are easier to clean
- install better lighting to reduce the likelihood of mishaps.

See:

• *Advisory standard for the selection, provision and use of personal protective equipment.*

Providing personal protective equipment is a last resort, because it does not control risks at their source. PPE should therefore be used in conjuction with one or more of the higher level control measures, and should not be relied on as the only control measure.

Employers should make sure:

- PPE is suitable for the person, tasks being done, category of substances being used and level of risk
- PPE is correctly used and regularly maintained according to the manufacturer's instructions
- each person is provided with PPE
- PPE is readily available including spare PPE
- respiratory protective equipment (RPE) is stored in an airtight container
- operators who use RPE are clean shaven to make sure there is an adequate face seal
- workers are trained in the use of their PPE

Workers must use PPE that the employer has provided.

CHOOSING AND USING PPE

When choosing PPE, consider controlling any risks that could be caused by it, for example, choose air-supplied respirators that:

- will not easily become tangled or caught on other objects
- generate less air noise, so the operator can hear warning signals.

If PPE must be worn for a long period of time, schedule rest breaks to help prevent problems such as heat stress.

PPE TRAINING

An employer must instruct workers in the use of PPE. This should include training about:

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

REVIEWING PPE

Regularly review the use of PPE to:

- make sure its use is still needed
- determine whether a higher level control measure would be better.

12 TRAINING

THE NEED FOR TRAINING

Employers must provide health and safety induction and on-going training for workers who may be exposed to hazardous substances.

Training helps workers to:

- learn about new developments
- continue to improve their knowledge and skills
- learn new jobs or new tasks before starting.

Also, refresher training may be useful, especially for workers returning to a work process after an extended period of leave or absence.

Training about hazardous substances and plant is needed for:

- workers who could be exposed to hazardous substances
- workers who use plant, or could be exposed to risk from plant
- new workers (before they use hazardous substances or plant)
- supervisors of the above workers
- those who purchase hazardous substances or plant
- those who select, implement, use and maintain control measures
- workplace health and safety officers and representatives
- those who have direct involvement in fire or emergency action.

ELEMENTS OF A TRAINING PROGRAM

Risk assessment is an important guide to what training is needed. More detailed training is needed when the risk is higher. Training should include:

- information about hazardous substances that workers could be exposed to including the nature of the hazards, risks to health, exposure standards and how the substances enter the body
- the nature of plant hazards, systems of work associated with the plant and the availability and use of information about the plant
- the correct way to label substances, the information that each part of the label provides and why the information is provided
- how to access Material Safety Data Sheets and the information they include
- the process to manage risks and how workers can contribute
- information on the correct use and maintenance of control measures
- procedures to be followed in case of an emergency, particularly those involving hazardous substances or plant, including any special decontamination procedures
- first aid and incident reporting procedures
- information about monitoring and health surveillance
- a worker's right to be consulted, and to be advised of any planned changes that might affect health and safety
- relevant duties of suppliers, employers and workers under the *Workplace Health and Safety Act 1995* and regulations
- the provisions of this guide.

TRAINING METHODS

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

Language and literacy factors should be considered when deciding the best training methods. If the literacy level is low, use verbal

or visual methods. Training should be given in the languages used by the workers in the workplace.

REVIEW OF TRAINING

Training should be reviewed to make sure workers are gaining the skills and knowledge they need. Inductions and other training programs should be reviewed about once a year and when there is a change in the hazard information available, the work practices or control measures.

RECORDS OF TRAINING

Employers must keep records of induction and training given to a worker about hazardous substances for five years. These should include:

- names of workers who receive training
- dates of training sessions
- topics dealt with
- names of trainers
- results of training evaluation or feedback.

While these legal requirements relate to induction and training about hazardous substances, it is desirable that similar records be kept about all training provided. It is also desirable that records be kept beyond five years if the people are still employed at the same workplace or by the same employer.

Training records should be readily accessible to workers.

13 HEALTH SURVEILLANCE

Health surveillance is the periodic checking of the health of a worker who may be exposed to hazardous substances. It helps lower the health risks from hazardous substances by:

- making sure that the absorbed dose is below the accepted level
- identifying biological effects that require lower levels of exposure or no exposure
- collecting data to evaluate the effects of exposure.

Employers should not use health surveillance in place of atmospheric monitoring as an indicator of possible health effects. Atmospheric monitoring indicates the potential for exposure to a substance whereas health surveillance indicates the amount of substance absorbed. It is not an alternative to maintenance of control measures. Costs include medical fees, pathology tests, travelling expenses and time away from work.

REQUIREMENT FOR HEALTH SURVEILLANCE

If a risk assessment shows that someone has been exposed to a hazardous substance and the substance is listed in Schedule 6 of the *Workplace Health and Safety Regulation 1997* or it has an adverse health effect that either has happened or is likely to happen, the employer or self-employed person must arrange for health surveillance.

TYPES OF HEALTH SURVEILLANCE

The types of health surveillance procedures that may be used include:

- biological monitoring of, for example, substances in blood, urine or expired air
- medical tests
- medical examination
- a review of present and past medical and work history
- a review of medical records and occupational exposure.

The results from one procedure may indicate the need for another.

A list of designated doctors who do health surveillance is available from Division of Workplace Health and Safety offices.

WHAT HEALTH SURVEILLANCE SHOULD COVER

Health surveillance generally takes into consideration:

- the nature and extent of exposure
- the changes that could occur in exposed workers and their likelihood
- the frequency at which changes may be expected
- available medical data
- an analysis of the extent of these changes
- action that can be taken to stop these changes
- what is needed to carry out the detection and/or measurement.

SELECTING A DOCTOR

Choose a doctor who:

- is registered as a specialist in occupational medicine or has satisfactorily completed a health surveillance training program
- is willing to visit the workplace so as to understand the hazards and work processes
- shows good interpersonal skills with workers
- is sensitive to other considerations essential to the workplace.

The doctor should be given:

- access to a list of the hazardous substances for which the workers are required to have health surveillance
- a copy of the substances' MSDSs and exposure standards
- a list of workers needing health surveillance
- access to any relevant assessment reports.

FOR MORE INFORMATION 14

For more information or for copies of this guide contact any DETIR (Workplace Health and Safety) office or phone 1300 369 915.

This document is available on the internet at the Queensland Government Department of Employment, Training and Industrial Relations homepage - http://www.detir.qld.gov.au/. The *Workplace Health and Safety Act 1995*, *Workplace Health and Safety Regulation 1997, Workplace Health and Safety (Miscellaneous) Regulation 1995* and advisory standards published by the Department can be obtained on this homepage or from Goprint, 371 Vulture Street, South Brisbane Q 4102, (07) 3246 3399.

Other legislation important to spray painting includes:

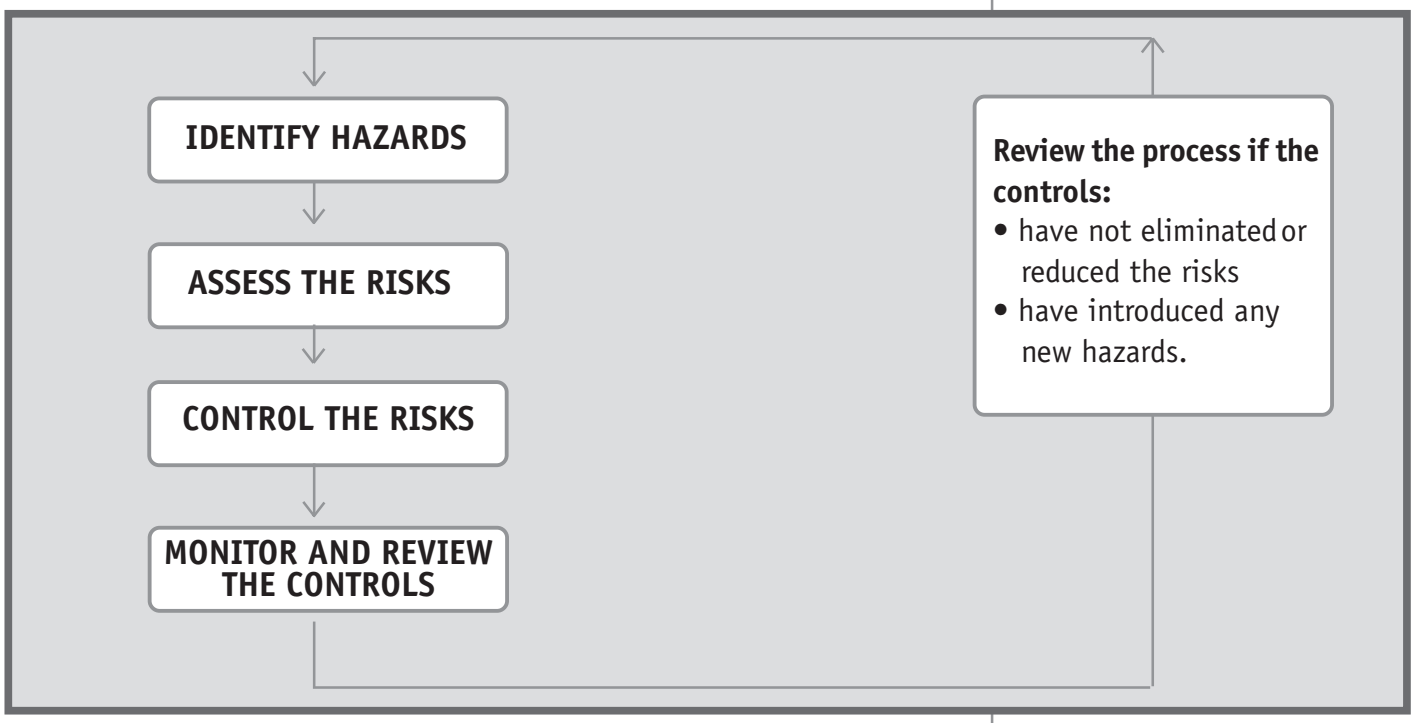
• ***Environmental Protection Act 1994*** • ***Environmental Protection Regulation 1998*** • ***Environmental Protection (Interim Waste) Regulation 1996*** • ***Environmental Protection Policies***	***contact your local authority or the Environmental Protection Agency Advisory Service on freecall 1800 501 087***
• ***Operator environmental guides for spray painting and metal surface coating adopted by many local authorities throughout Queensland***	***contact your local authority***
• ***Building (Flammable and Combustible Liquids) Regulation 1994***	***contact your local authority***
• ***Requirements for placarding for dangerous goods stored at a workplace to help with their identification in case of an emergency***	***contact CHEM Unit, Department of Emergency Services telephone (07) 3247 8444***
• ***Requirement for fire safety (including fire extinguishers)***	***contact your nearest Regional Public Safety Officer, Queensland Fire and Rescue Authority.***

APPENDIX A - PROCESS FOR RISK MANAGEMENT

Workplace health and safety can generally be managed by:

- **identifying** hazards
- **assessing** risks that could result because of the hazards
- **controlling** the risks
- **monitoring and reviewing** the controls.

This process is illustrated below.



IDENTIFYING HAZARDS

A hazard is something that could cause injury or illness. They can be identified by:

- consulting with workers – workers can assist by giving information based on their experience and also their symptoms or health effects
- inspecting the workplace and doing walk-through surveys
- reviewing MSDSs, product labels and manufacturers' specifications
- reviewing incident, accident and injury data
- seeking advice from specialist practitioners.

ASSESSING RISKS

Risk is the likelihood that a hazard will cause injury or illness. The level of risk depends on the nature of the hazard and the way people interact with it.

Nature of the hazard

Consider the hazard in terms of how it could do harm and how severe that harm would be. Make sure all types of harm from each hazard are identified.

How people interact with the hazard

Consider the way people interact with a hazard, for example:

- the number of people who could be exposed to the hazard
- how often and for how long they could be exposed
- how they are exposed, for example, being exposed to hazardous substances by breathing it in, skin contact, swallowing, eye contact, injection
- whether the existing methods of controlling the risks from each hazard are adequate.

Example of the way people interact with the hazard:

There are five workers regularly spraying paints that can cause serious health effects. The workers 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 workers 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 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 workers are less likely to be directly exposed and the risk is reduced. On the other hand, if the workers are regularly exposed to vapours and aerosols because adequate control measures are not in place, the probability of severe effects is increased.

Evaluating the level of risk

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

- **low risk** (and is unlikely to increase)
  - there is hardly any risk, for example, the amounts of the substance used are too small to cause much harm, even if controls fail
  - the substance can cause minor effects, but its use is being strictly controlled in line with the MSDS (or equivalent) and workers have been trained
  - the substance can cause minor effects but its use can be easily controlled in line with the MSDS.
- **medium risk** – although the substance is category 2 (medium risk) and a number of people could be affected on a daily basis, use of the substance is strictly controlled in line with the MSDS and using effective engineering controls; no evidence of exposure has been found during the assessment
- **high risk** – the potential harm is serious and the likelihood of exposure is high, for example:
  - the substance is category 1 (high risk)
  - dusts, mists or fumes are visible in the air
  - there are widespread complaints of illness, discomfort or irritation
  - splashes are present
  - workers have not been trained.
- **uncertain risk** – 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.

Potential for harm from exposure to the hazard	Potential for harm from interaction with hazard		
	Highly likely	Reasonably likely	Unlikely
High	HIGH RISK	HIGH RISK	MEDIUM TO HIGH RISK
Moderate	HIGH RISK	MEDIUM TO HIGH RISK	MEDIUM RISK
Low	MEDIUM RISK	MEDIUM TO LOW RISK	LOW RISK

Acting on the assessment

While all risks need to be controlled, **high** risks are the first priority.

Assessment results are the basis for an effective risk control program. The assessment will also show whether hazardous substances monitoring or worker health surveillance is needed.

High risks:

- control measures **must** be identified and implemented **immediately**
- consider whether the process should be stopped until risk can be controlled
- consider whether monitoring and/or health surveillance is required
- consider whether a more detailed assessment is needed
- do another assessment when controls are in place to see if other, longer-term controls are needed.

Low or medium risks:

- the assessment is completed as soon as any required controls are implemented and workers are trained in their use
- for medium risks, a longer-term control program might aim to eventually reduce the risk level, for example, using a less hazardous substance.

Uncertain risks:

- carry out a more detailed assessment
- put interim control measures in place with the aim of reducing potential exposure as much as possible.

It is important to make sure controls are maintained and that workers are trained in their use. Controls can deteriorate and this might not be apparent straight away, for example, plant could fail.

Records to be kept about hazardous substances

By law, the following records associated with **hazardous substances** must be kept by the employer or self-employed person:

- risk assessment records
- results of monitoring
- health surveillance reports.

These documents must be kept for 30 years if the assessment shows there is a significant degree of risk to health. This is necessary because some diseases, for example, cancers, take a long time to become evident. If the degree of risk is not significant, the risk assessment record only needs to be kept for five years.

All of these documents are to be available for inspection by any worker who could be exposed to hazardous substances.

Risk assessment records should include:

- the name of the assessor/s
- description of the hazard and the routes of entry to the body
- description of normal operations in the work area
- procedures used to assess exposure
- procedures used to assess the degree of exposure
- procedures used to assess existing control measures
- conclusions from the assessment, for example, whether the risk was not significant or significant
- action to be taken
- induction, training, emergency procedures and health surveillance action to be taken
- the circumstances when reassessment will be required
- signature, date and position of the assessor/s
- signature, date and position of the employer accepting the assessment.

CONTROLLING RISKS

Exposure of workers to workplace hazards must be prevented either by eliminating the hazards or by controlling the risks as far as possible. Information gathered during the assessment will help to determine appropriate control measures. This should be done in consultation with workers or workplace health and safety representatives.

There are often a number of ways to address a particular risk. Choose the level of control from as high on the following list as possible (Level 1 is the highest). In many instances, a combination of two or more control measures will need to be used to make sure the risk is eliminated or reduced.

- Level 1 – **elimination** of hazards
- Level 2 – **substitution** with a safer alternative
- Level 3 – **isolation** of the risk
- Level 4 – **engineering controls**
- Level 5 – **administrative controls**
- Level 6 – use of **personal protective equipment**

Longer-term plans may be made to use control measures from a higher priority level. For example, elimination of a particular substance may not be possible now, but will be in the future.

MONITORING AND REVIEWING CONTROLS

Control measures should be:

- regularly reviewed and tested to make sure they stay effective and do not create new risks
- reviewed if work-related ill health is reported
- reviewed if there is a change to the work processes or substances.

Reviewing the process itself

Examine the process in consultation with workers to determine where and how it could be improved. For example, were all hazards identified? 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?

Reviewing the risk control measures being used

- review the control measures regularly, for example:
  - less hazardous substances, plant and processes should be substituted for more hazardous ones whenever possible
  - isolation measures should be evaluated to ensure they are protecting workers
  - engineering controls should be thoroughly examined and tested at intervals as recommended by the manufacturer or as specified in the relevant Australian Standard
  - administrative controls should be checked to make sure they are being followed
  - the use of personal protective equipment should be reviewed.
- establish procedures for servicing and maintaining those control measures that require it, including the frequency of maintenance, who is responsible, how any defects will be corrected, performance testing and evaluation standards and records of servicing
- check that implementation of the control measures has not created further hazards
- encourage workers to report any defects they notice in control measures, equipment, machinery, facilities or labelling as soon as possible
- make long-term plans to improve health and safety by gradually incorporating preventive measures into management systems and by planning to use higher level controls, for example, you might aim to introduce a *buy safe* policy, plan for the substitution of major hazards with less hazardous alternatives, upgrade training programs and improve workplace communication.

APPENDIX B - INTERPRETING AN MSDS

A blank Material Safety Data Sheet (MSDS) form is set out below with guidance on the information that can be found in the various sections.

COMPANY DETAILS

Company:_____ Date of Issue:____/____/____
Address:_____
Telephone Number:_____
Emergency Telephone Number:_____

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 – stage one of the four stage process.

Dangerous Goods Class tells you the kind of danger, for example, Class three – 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. This can be a guide as to whether health surveillance might be necessary, for example, isocyanates, inorganic chromium, lead.

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 – stage two of the four stage 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 – stage three of the four stage 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 explosion including the fumes given off from a product and recommendations for fighting the fire.

APPENDIX C - RISK CATEGORIES OF SPRAY PAINTING SUBSTANCES

The risk phrases referred to in this appendix can be found in Appendix 3 of the Approved Criteria for Classifying Hazardous Substances (NOHSC1008(1999)) and in Appendix 1 of the List of Designated Hazardous Substances (NOHSC:10005 (1999)).

HAZARDOUS PROPERTY	EXAMPLES		WORKPLACE INFORMATION TRIGGERS
Category 1 (HIGH RISK) Substance			
Is, or contains, a cancer causing chemical	**Chromates** (see Chromium VI)	**R49** R43	**Exposure Standard** **Health surveillance** **Label:** "May cause cancer by inhalation" (R49)
	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
Is, or contains, a skin or respiratory sensitiser	**Chromates**	**R43** R49	**Label:** "May cause sensitisation by skin contact" (R43)
	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)
Is, or contains, a substance which causes reproductive effects	**Ethoxyethyl acetate**	**R60/61** R20/21/22	**Exposure Standard** **Label:** "May impair fertility" (R60) **Label:** "May cause harm to unborn child" (R61)
	Lead compound	**R61/62** R20/22, R33	**Label:** "Possible risk of impaired fertility" (R62)

APPENDIX C - RISK CATEGORIES OF SPRAY PAINTING SUBSTANCES

HAZARDOUS PROPERTY	EXAMPLES		WORKPLACE INFORMATION TRIGGERS
Is, or contains, a substance which causes severe effects after repeated or prolonged exposure	**Tributyltin compounds**	**R48/23/25** R36/38, R25, R21	**Label:** "Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed" (R48/23/25)
	Lead compounds	**R33** R61/62, R20/22	**Label:** "Danger of cumulative effects" (R33)
	Mercury ***Cadmium**	**R33** R23	*Some Cadmium compounds require: **Label:** "Toxic" (R48/23/25) **Label:** "Danger of cumulative effects" (R33)
Is, or contains, a metallic compound which is a hazardous substance	**Lead**		**Exposure Standard** **Health surveillance**
	Lead compounds	**R61/62** R20/22, R33	**Label:** "May cause harm to unborn child" (R61) **Label:** "Possible risk of impaired fertility" (R62)
	Mercury	**R33** R23	**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)
	Cadmium compounds	R20/21/22	
Is, or contains, a substance which causes non-lethal irreversible effects	**Formaldehyde**	**R40** R34, R43, R23/24/25	**Exposure Standard** **Label:** "Possible risk of irreversible effects" (R40)
	***Cadmium**		*Some Cadmium compounds require: **Label:** R40
Is, or contains, a substance which causes acute irritant effects	**Epoxy resins**	**R36/38** R43	**Label:** "Irritating to eyes and skin" (R36/38)
	Styrene	**R36/38** R20	**Exposure Standard** **Label:** "Irritating to eyes and skin" (R36/38)
	Methyl ethyl ketone	**R36/37**	**Exposure Standard**
	Tributyltin compounds	**R36/38** R48/23/25, R25, R21	**Label:** "Irritating to eyes and respiratory system" (R36/37) **Label:** "Irritating to eyes and skin" (R36/38)
	2-butoxyethanol	**R37** R20/21/22	**Exposure Standard** **Label:** "Irritating to respiratory system" (R37)

APPENDIX C - RISK CATEGORIES OF SPRAY PAINTING SUBSTANCES

HAZARDOUS PROPERTY	EXAMPLES	WORKPLACE INFORMATION TRIGGERS
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"
Is, or contains, a corrosive substance, or is a Dangerous Goods (DG) Class 8 products	**Formaldehyde** **R34** R40, R43, R23/24/25	**Exposure Standard** **Label:** "Corrosive. Cause burns" (R34)
Is a DG Class 5 product		**MSDS** says DG Class 5.1, 5.2. **Label** shows a DG Class 5 diamond
Is a 2 or more pack paint	A polyurethane paint and its hardener	**MSDS** **Label**
Category 2 (MEDIUM RISK) Substance		
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
Category 3 (LOW RISK) Substance		
Does not contain any substance that meets Category 1 or Category 2 criteria		**MSDS** **Label**

APPENDIX D - EXAMPLES OF RISK ASSESSMENT

High risk

A large assembly plant employs two painters full-time to spray-paint truck panels with a two-pack polyurethane finish. These workers prepare and mix the paint, carry out all spraying tasks and regularly clean equipment for re-use. While all spraying work is done in a spray booth, the paint mixing and clean-up are done in the general factory area. The painters are given half-face filter organic vapour respirators and rubber gloves to use while spray painting. The employer is considered to have access to 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 risk) substance.

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

Health hazard information in the MSDS says isocyanates can cause respiratory irritation, sensitisation (asthma), skin sensitisation from prolonged exposure and chemical conjunctivitis. They are considered capable of causing severe harm to the users.

Questioning the painters, the employer discovers that one has suffered occasional asthma attacks since childhood.

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

The employer seeks advice from an occupational hygiene consultant to see if filter respirators already at the workplace will suffice. The 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
- the existing filter respirators cannot provide enough protection.

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 workers, 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 remove their respirators while still in the spray booth.

Mixing paint and cleaning spray painting equipment is done 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 reasons for the conclusion are:

- rubber gloves are inadequate protection
- 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 overexposure
- health effects to the skin and to the respiratory system can be severe from overexposure.

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 organised in consultation with the workers
- air supplied respirators with the full-face pieces for eye protection and better whole body protection
- appropriate induction and training so the workers understand the hazards, risks and new control equipment.

Medium risk

A cabinetmaking 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 worker conducts all painting operations but people working nearby (15-18 metres away) are regularly exposed to vapours from overspray that can easily be smelled. The employer is considered capable of conducting the **risk assessment** of the existing hazards, risks and the controls already in place.

During this process, the employer notes that the label on 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 as a Category 2 (medium risk) 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
- short-term exposure limit (STEL) for acetone is listed at 1000 ppm.

The review of the work procedures indicates:

- spray painting in the open with a low pressure high volume air system results in high amounts of vapour which, as the solvent evaporates, concentrate mainly in the breathing zone of the spray painter
- during the spray gun and pot clean-up process, solvent is liberally applied but no 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
- 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 found that the short-term peak exposures during spraying were 1500 ppm for 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 concentrations reaches a maximum of 50 ppm for the acetone and eight ppm for 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
- 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 skin protection during spraying and clean-up operations
- providing overalls for whole body protection.

Air monitoring has confirmed that the bystander workers 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 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 clean-up with spraying comprising about half the total shift time. 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 shows that the paint contains no substances that would classify it as either high or medium hazard. This paint system is considered to be a Category 3 (low risk) substance.

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 personal protective equipment recommendations for Category 3 (low risk) substances shows that for indoor use without ventilation the following precautions are required:

- full face respirator with class three filters and external prefilter to provide the required eye protection
- disposable overalls, probably cellulose
- 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 is low
- decisions on protection are simple and straightforward
- detailed examinations of the work practices are not needed
- the implementation of the controls is straightforward and uncomplicated.

A sample risk assessment worksheet is set out on the next 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** 14/5/99

TASKS: Paint mixing Colour matching Spraying Baking Clean-up

HAZARDS IDENTIFIED: 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.

REVIEW OF HAZARDS: *Labels* – paint system XYZ indicates hardener contains HDI – hexamethylene diisocyanate. Paint identified as Category 1. Risk and safety phrases present.
MSDS – 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.
Plant – generation of explosive atmospheres by spraying, flammable solvents and rags; need to have ignition-proof environment.

STAFF & PERSONNEL: Workers – P. Pott, L. Noyes, D. Blue
Work schedule – approximately 1.5 hour prep mixing, five hour spraying and 1.5 hour clean-up.

	Paint mixing	Colour matching	Spraying	Baking	Clean-up
POSSIBLE EXPOSURES IN EACH TASK	• 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.	• conducted indoors • no ventilation • intermittent inhalation exposure to spray paint aerosols • hands protected but body unprotected.	• conducted in spray booth • possible inhalation 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.	• vapours from curing paint and solvents • access to drying line unusual.	• skin exposure extreme to gun washing solvents • inhalation of cleaning solvent and residual paint vapours as work is conducted in open • area contaminated by solvent in cleaning rags.
EXISTING CONTROL	None.	Latex gloves only.	Half-face respirator (Class 2). Latex gloves, spray booth AS 4114.	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. 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 half-face respirator **or** by using a specially constructed extracted booth • skin protection by chemically resistant gloves required.	• 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 protection required; chemically resistant gloves • inhalation protection from solvent vapours by using air supplied respirator • alternatively, conduct all equipment cleaning in an automatic solvent washing system.

MONITORING & 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).

APPENDIX E - SPRAY ZONES FOR DIFFERENT CATEGORIES OF SUBSTANCES IN DIFFERENT VENTILATION CONDITIONS

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS (The time before an unprotected person enters a spray zone)	SOURCE	COMMENTS
Category 1 (HIGH RISK) Substances				The distances and time factors stated have been estimated based on typical environmental conditions. They may not be practicable for all conditions. Risks from explosion and the inhalation of hazardous substances will depend on the conditions under which certain types of paints are applied. Extremes of temperature, humidity or wind speed, or the presence of obstacles to wind flow, may increase the risk and require an extension of the spray zone distances beyond those stated. The spray painting process will also affect the level of risk. Therefore, the spray zone distances and time factors should be determined after conducting an assessment of the risk involving all factors. The risk control factors of distance and time are provided as a guide and are based on AS/NZS 4114.1 - Spray painting booths and AS2430.1 - Classification of hazardous areas-explosive gas atmospheres. These Standards primarily consider the fire and explosion hazards. Controls for the risk of exposure to hazardous substances <u>may</u> be addressed by the distance and time factors quoted. However, health effects <u>may</u> occur at much lower concentrations than significant fire/ explosion risk. Consequently, appropriate controls to take account of health effects should be part of a risk assessment. This may require monitoring of air quality to make sure concentrations are not exceeding exposure standards. Controls must be used for touch up.
Inside closed spray booth complying with AS/NZS 4114.1.	A spray zone does not apply outside a closed operating spray booth provided you comply with the time factor stated in the next column.	At least five minutes after spraying with spray booth operating.	AS/NZS 4114.1	
Inside exhaust ventilated enclosed area (eg. blast unit, closed hangar with exhaust ventilation, temporary enclosure supplied with local exhaust ventilation e.g. 'mucksucker'; domestic bathroom with doors and windows sealed and supplied with local exhaust ventilation).	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	
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 five minutes after spraying with spray booth operating.	AS/NZS 4114.1	
Indoors without exhaust ventilation.	Category 1 paints should <u>not</u> be sprayed for any reason (including touch-ups) without exhaust ventilation, unless other suitable means of safely limiting exposure to those in the area are in place.			
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.	*Polyurethane Coatings: performance, quality, safety,* Bayer, 1989, Pittsburgh	

APPENDIX E - SPRAY ZONES FOR DIFFERENT CATEGORIES OF SUBSTANCES IN DIFFERENT VENTILATION CONDITIONS

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS (The time before an unprotected person enters a spray zone)	SOURCE	COMMENTS
Category 2 (MEDIUM RISK) Substances				The distances and time factors stated have been estimated based on typical environmental conditions. They may not be practicable for all conditions. Risks from explosion and the inhalation of hazardous substances will depend on the conditions under which certain types of paints are applied. Extremes of temperature, humidity or wind speed, or the presence of obstacles to wind flow, may increase the risk and require an extension of the spray zone distances beyond those stated. The spray painting process will also affect the level of risk. Therefore, the spray zone distances and time factors should be determined after conducting an assessment of the risk involving all factors. The risk control factors of distance and time are provided as a guide and are based on AS/NZS 4114.1 - Spray painting booths and AS2430.1 - Classification of hazardous areas-explosive gas atmospheres. These Standards primarily consider the fire and explosion hazards. Controls for the risk of exposure to hazardous substances may be addressed by the distance and time factors quoted. However, health effects may occur at much lower concentrations than significant fire/ explosion risk. Consequently, appropriate controls to take account of health effects should be part of a risk assessment. This may require monitoring of air quality to make sure concentrations are not exceeding exposure standards. Controls should be used for touch up.
Inside closed spray booth complying with AS/NZS 4114.1.	A spray zone does not apply outside a closed operating spray booth provided you comply with the time factor stated in the next column.	At least five minutes after spraying with booth operating.	AS/NZS 4114.1	
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	
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 five minutes after spraying with booth operating.	AS/NZS 4114.1	
Indoors without exhaust ventilation.	Distances from any opening or outlet should be determined by conducting a risk assessment.	Until concentration of volatile organic solvent or other volatile components has dropped below exposure standard.		
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.	*Polyurethane Coatings: performance, quality, safety,* Bayer, 1989, Pittsburgh	

APPENDIX E - SPRAY ZONES FOR DIFFERENT CATEGORIES OF SUBSTANCES IN DIFFERENT VENTILATION CONDITIONS

VENTILATION CONDITIONS	DISTANCE	TIME FACTORS (The time before an unprotected person enters a spray zone)	SOURCE	COMMENTS
Category 3 (LOW RISK) Substances				The principles applied to the selection of spray zones for Categories 1 & 2 substances primarily relate to flammability. They are not applied to Category 3 substances here as these substances are not likely to be flammable. Prolonged exposure to Category 3 substances may cause some health effects, such as dermal or respiratory irritation. Therefore, the spray zones suggested relate mainly to potential health effects from prolonged exposure. Spray zone distances and time factors should be determined after conducting an assessment of the risk. Short term exposure may require administrative and PPE controls in the absence of spray zones.
Inside closed spray booth complying with AS/NZS 4114.1.		At least five minutes after spraying with booth operating	AS/NZS 4114.1	
Inside exhaust ventilated enclosed area.	Should not need to be more than 2 metres extending in all directions from any opening or outlet			
Inside open spray booth complying with AS/NZS 4114.1	Should not need to be more than 2 metres extending in all directions from any opening or outlet	At least five minutes after spraying with booth operating	AS/NZS 4114.1	
Indoors without exhaust ventilation.	Should not need to be more than 3 metres extending in all directions from any opening or outlet			
Outdoors.	Should not need to be more than 3 metres in all directions			

APPENDIX F – PPE SUGGESTED UNDER DIFFERENT VENTILATION CONDITIONS

All respiratory personal protective equipment should be selected after considering:

- **recommendations of the manufacturer outlined in the relevant MSDS**
- **the outcome of a comprehensive risk assessment**
- **the minimum standards outlined in *AS/NZS 1715 – Selection, use and maintenance of respiratory protective devices***
- **the *Advisory standard for selection, provision and use of personal protective equipment.***

VENTILATION CONDITIONS	PPE
Category 1 (high risk) and Category 2 (medium risk) substances	
• inside a spray booth • indoors with ventilation • indoors without ventilation • outdoors	**hearing protection** Hearing protection devices conforming to *AS 1269 – Occupational noise management,* to reduce noise exposure to below the limits specified in section 68 of part 10 of the *Workplace Health and Safety Regulation 1997,* that is, 85dB(A) as an average level over an eight hour day, (84dB(A) over 10 hours or 83dB(A) over 12 hours) (see Chapter 8). **respiratory protection,** (see note below) Air supplied full facepiece respirator or head covering respirator (may be disposable). This will also protect eyes and facial skin. Tested for fit before use and complying with *AS/NZS 1716 – Respiratory protective devices*. **skin protection,** (see note below) Full skin cover including: • disposable overalls and head covering (as needed) • impervious gloves – check MSDS • boots • disposable boot protective covers.

NOTE:

The PPE recommended for Category 1 (high risk) and Category 2 (medium risk) substances may not be practical for safety or operational reasons. For instance, in situations where the use of air supplied respirators increase the risk of injury to the operator, alternative respiratory protection of equivalent performance can be used.

The respiratory protective equipment required will depend on the conditions under which the paints are applied. They must be selected as part of the risk assessment and control process. The following points need to be considered:

- exposure standards for the various paint components
- manufacturer's MSDS and recommendations
- ventilation in the areas where the paint is to be applied
- exposure level and duration of exposure
- protection factor of the respirator
- requirements for PPE under the *Workplace Health and Safety Act 1995* and regulations (see Chapter 11).

PPE protection should be the same for Category 2 (medium risk) substances as for Category 1 (high risk) unless the risk assessment determines otherwise.

Category 3 (low risk) substances	
in all ventilation conditions	**hearing protection** Same as for Category 1 (high risk) and Category 2 (medium risk) substances.
inside a spray booth	**respiratory protection,** (see note below) A full facepiece respirator with an external pre-fitted filter for particulates in combination with a Class 3 gas filter. This will also protect eyes. **skin protection** This is determined by risk assessment, for example, overalls may not need to be disposable, or head covering and/or boot covers may not be needed.
indoors with ventilation	**respiratory protection**, (see note below) A full facepiece respirator with an external pre-fitted filter for particulates in combination with a Class 3 gas filter. This will also protect eyes. **skin protection** Determined by risk assessment.
indoors without ventilation	**respiratory protection**, (see note below) A full facepiece respirator with an external pre-fitted filter for particulates in combination with a Class 3 gas filter. This will also protect eyes. **skin protection** Full skin cover including: • disposable overalls • head covering (as needed) • gloves – check MSDS • boots • disposable boot protective covers.
outdoors	**respiratory protection**, (see note below) A full facepiece respirator with an external pre-fitted filter for particulates in combination with a Class 3 gas filter. This will also protect eyes. **skin protection** Determined by risk assessment.

NOTES

The respiratory protective equipment required for Category 3 (low risk) will depend on the conditions under which the paints are applied. They must be selected as part of the risk assessment and control process. Consider:

- exposure standards for the various paint components
- manufacturer's MSDS and recommendations, (the MSDS generally indicates the potential for eye and respiratory irritation from some Category 3 (low risk) paints)
- ventilation in the areas where the paint is to be applied
- the exposure level and duration of exposure
- protection factor of the respirator
- requirements for PPE under the *Workplace Health and Safety Act 1995* and regulations (see Chapter 11).

Guide for Employers and Operators

Spray Painting

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