POTENTIALLY HAZARDOUS PROCESSES

LEARNING OUTCOME

Describe the requirements of the Work Health and Safety legislation and standards and the control strategies needed to minimise or manage the hazards associated with spray painting and, abrasive blasting.

ASSESSMENT CRITERIA

- Describe the statutory and minimum requirements relating to spray painting, and abrasive blasting.
- Describe control strategies required for hazards associated with spray painting, and abrasive blasting.

REFERENCES

- Work Health and Safety Act 2011;
  - Part 2 – Duties
- Work Health and Safety Regulation 2011;
  - Chapter 3 – General Risk and Workplace Management
  - Chapter 7 – Hazardous Chemicals
- Spray Painting and Powder Coating Code of Practice 2013;
- Abrasive Blasting Code of Practice 2013;
- AS/NZS 1715:2009 *Selection, use and maintenance of respiratory protective equipment*
- AS 3754:1990 *Safe application of powder coatings by electrostatic spraying*
- AS/NZS 4114.1:2003 *Spray painting booths, designated spray painting areas and paint mixing rooms – part 1: design, construction and testing*;
- AS/NZS 4114.2:2003 *Spray painting booths, designated spray painting areas and paint mixing rooms – part 2: installation and maintenance*;
- AS 1627.4:2005 *Metal finishing – preparation and pretreatment of surfaces – part 4: abrasive blast cleaning of steel*;
- AS 1788.1 *Abrasive Wheels – part 1: design, construction, and safeguarding*;
- AS 1788.2 *Abrasive wheels – part 2: selection, care, and use*.

POTENTIALLY HAZARDOUS PROCESSES
SPRAY PAINTING

REFERENCE: SPRAY PAINTING AND POWDER COATING CODE OF PRATICE 2013

SPRAY PAINTING

Spray painting including electrostatic spray painting, is a process by which liquid paint is applied under pressure to an object. Spray painting may be carried out by hand or automatically. There are several methods used to atomise the paint for spraying:

- Using a conventional air compressor – air is driven across the mouth of a small outlet under pressure to draw liquid paint out of the container and produce an air-paint mist from the nozzle of the spray-gun.

- Airless spray painting – the paint container is pressurised pushing the paint to the nozzle where it is atomised by the spray gun; or
- electrostatic spray painting – an electric pump drives the electrostatically charged liquid paint out of the nozzle which is then applied to the object which is earthed.

Powder coating is a process by which electrostatically charged powder is applied onto an earthed object.

Spray painting and powder coating are carried out in a variety of industries. For example, items that are commonly spray painted include motor vehicles, buildings, furniture, white goods, boards, ships, aircraft and machinery.

HAZARDS ASSOCIATED WITH SPRAY PAINTING

Hazardous chemicals pose the major hazard in spray painting and will be discussed within these notes. 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.

These hazards are dealt with specifically within the code of practice but will not be a feature of these notes.

WHAT ARE HAZARDOUS CHEMICALS FOR SPRAY PAINTING?

The spray painting processes involving hazardous chemicals include:

- Preparation (including preparing surfaces, tinting, mixing and pouring paints);
- Spray painting;
- Storage, clean-up and disposal.

The hazardous chemicals used include paints, solvents, powders, lacquers, paint removers, resins, adhesives, surface preparation products, rust converters and rust removers. In most cases the product label and SDS will identify any hazardous chemicals.

Isocyanates

Isocyanates are commonly found in 2-pack liquid spray paints, varnishes, adhesives and polyurethane plastics. Isocyanate polymers may also be present in paints including:

- polyisocyanate
- isocyanate pre-polymer
- isocyanate polymer, and
- polymerised isocyanates

Exposure to isocyanates can occur when aerosols, mists or powder paints containing isocyanates are released into the atmosphere during spraying or powder coating. Exposure to isocyanates can also occur during sanding of polyurethane paint that is not fully cured, as this activity can generate dusts containing un-reacted isocyanates. Further, isocyanate-containing materials may release isocyanates into the atmosphere when heated. Exposure to isocyanates should be considered as high risk.

Lead

Workers who carry out surface preparation (such as preparing old vehicles for spray painting) could be exposed to lead when removing and sanding lead-based paints.

Paint that contains lead can no longer be purchased in Australia and the use of lead-free paints will eventually eliminate exposure to lead and the associated risks.

The WHS Regulation contain specific requirements for working with lead including the identification of lead risk work and removing a worker from lead risk work in certain circumstances.

HEALTH EFFECTS OF HAZARDOUS CHEMICALS DUE TO SPRAY PAINTING

Potentially all workers engaged in spray painting, or working nearby, can exposed to hazardous chemicals. 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.

CONTROLLING RISKS FROM HAZARDOUS CHEMICALS

Risks from hazardous chemicals 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 chemicals
- Use an alternative to spray painting, i.e. a dipping process.

Substitution, for example:

- use a water-based paint instead of an organic solvent based coating;
- use a brush or roller instead of a spray gun;
- use a triglycidyl isocyanurate-free (TGIC) powder coating instead of one containing TGIC;
- use high volume low pressure (HVLP) spraying rather than airless spraying; or
- use a low hazard cleaning solvent.

Isolation and enginerring controls, for example:

- Automate the process
- Use spray booths as they effectively isolate other workers from the hazard
- Designate an area as a spray zone.
- 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

Spray booths are enclosed or partially enclosed structures designed to prevent or reduce exposure to hazardous chemicals or vapours.

Types of spray booths include:

- **Open-faced spray booths** generally have two walls, roof with air extraction, a filtered rear wall and an open front.
- **Enclosed type batch booth** is a room or large cabinet where the operator enters and spraying is conducted. The airflow is either down draught, cross draught, end draught or any combination thereof.
- **Tunnel or production spray booths** for mass produced items requiring a continuous painting application process. These booths are usually down draught or cross draught and have open ends.
- **Full downdraft spray booths**, where air enters the booth from the ceiling through a filtering system, and moves downwards vertically. Heavy and large objects, like cars, which are not easy to handle are often painted in the down draft spray painting booths.
- **Semi downdraft booths**, where fresh air enters the booth from outside the building, is ducted through the roof intake filters, and is drawn towards the rear exhaust wall of the booth where it is exhausted through filters.

A spray booth must be used when spray painting a hazardous chemical, 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).

Spray booths should:

- be designed, constructed and installed to comply with AS/NZS 4114.1: *Spray painting booths, designated spray painting areas and paint mixing rooms – Design, construction and testing* and AS/NZS 4114.2: *Spray painting booths, designated spray painting areas and paint mixing rooms – Installation and maintenance;*
- be fitted with an exhaust capture system and a ventilation system that includes a filter for removing airborne contaminants;
- have 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
- be inspected at regular intervals and properly maintained.

VENTILATION

Two common types of ventilation used in spray painting are:

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.

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.

SPRAY PAINTING OUTSIDE A SPRAY BOOTH

When spray painting outside a spray booth or outdoors, a spray painting exclusion zone should be designated around the area where the spray painting is carried out. In general, the exclusion zone should, as far as is reasonably practicable, have at least six metres horizontal and two metres vertical clearance above and below the place where the paint is being applied. However, in deciding where to establish an exclusion zone and how big it should be, you should consider:

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

Once a spray paint exclusion zone is established, a number of procedures can be used to control risks including:

- physical barriers and warning signs to prevent unprotected persons from entering the exclusion zone;
- shrouding the area where spraying is to occur to prevent spray drift in walkways, public areas and air conditioning intake vents;
- removing hazardous chemicals that are not needed for spray painting work to reduce unnecessary exposure and fire or explosion risks;
- using low hazard chemicals for surface preparation or cleaning;
- removing stored wastes, like solvent-soaked rags and waste paint, to control fire or explosion risks;
- removing electrical and ignition sources from within the exclusion zone to control fire and explosion risks;
- restricting spraying when wind speeds are likely to spread spray drift;
- restricting spraying when there is a close proximity to adjacent premises and property.

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.

TRAINING

Workers who are involved in spray painting or powder coating activities require relevant information, training, instruction or supervision to enable them to carry out their work safely. For example, this must include information on:

- the proper use, wearing, storage and maintenance of personal protective equipment (PPE)
- working in hazardous environments such as confined spaces
- first aid and emergency procedures
- how to access SDSs for workers using, handling or storing hazardous chemicals
- the nature of, and reasons for, any health monitoring if required.

Training should be practical and where relevant include hands-on sessions (e.g. correctly setting up a spray zone or practising emergency procedures).

PERSONAL PROTECTIVE EQUIPMENT

All respiratory personal protective equipment should be selected after considering:

- recommendations outlined in the relevant safety data sheet (SDS) or in the spray painting and powder coating code of practice 2013;
- the outcome of a comprehensive risk assessment;
- the minimum standards outlined in AS/NZS 1715 – *Selection, use and maintenance of respiratory protective devices.*

When spraying two part polyurethane paint the sprayer should wear:

- an air-supplied respirator, and
- full length overalls with hood, appropriate chemically resistant gloves and eye protection.

Alternative respiratory protection may only be used in situations where the use of supplied air respirators increases the risk of injury to the operator due to falls, trips or slips.

SUPPLIED AIR

To ensure that supplied air is free contaminates, compressors used to provide breathing air must:

- Be designed to provide clean breathing air
- Have a pressure regulator and filtration system, located as close as practicable to the worker
- Have records of regular air quality testing
- Be located well away from sources of contaminant, particularly exhaust gases from operating plant, equipment of vehicles, or where exhaust fumes may accumulate
- Supplied air hoses must be protected from risk of damage and kinks

Note about compressors powered by internal combustion engine:

- There is an inherent risk that the air supplied can be contaminated with harmful gases and substances including carbon monoxide.
- When air compressors powered by an internal combustion engine continue to operate when overheated, there is a risk the engine oil burning and producing excessive amounts of carbon monoxide.
- Exposure to carbon monoxide in this way has resulted in operator deaths.
- Make sure to supply a breathing air system that is designed for safe use with supplied air respirators. A compressor used to supply industrial air may not be suitable for breathing air.
- Periodically test the air quality. This should include installing a continuously operating carbon monoxide monitor with an alarm in a position as close to the user as possible on oil-lubricated compressors.

VENTILATION CONDITIONS	PERSONAL PROTECTIVE EQUIPMENT
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 AS1269 – Occupational noise management, to reduce noise exposure to below the limits specified in section 56 of chapter 4 of the Work Health and Safety Regulation 2011, that is, 85dB(A) as an average level over an eight hour day, (84dB(A) over 10 hours or 83dB(A) over 12 hours). **Respiratory protection** Air supplied full face piece respirator or head covering respirator (may be disposable). This will also protect eyes and facial skin. Tight fitting respirators must be fit tested in accordance with the requirements of AS/NZS 1715 – *Selection, use and maintenance of respiratory protective devices*. **Skin protection** Full skin cover including: • Disposable overalls and head covering (as needed) • Impervious gloves – check SDS • Boots • Disposable boot protective covers
Category 3 (low risk) substances	
In all ventilation conditions	**Hearing protection** Same as for Category 1 (high risk) and Category 2 (medium risk) substances.
Indoors with ventilation	**Respiratory protection** A full face piece respirator with an external pre-fitted filter for particulates in combination with an organic vapour class 1, 2 or 3 gas filter. This will also protect eyes. Tight fitting respirators must be fit tested in accordance with the requirements of AS/NZS 1715 – *Selection, use and maintenance of respiratory protective devices*.

	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 without ventilation	**Respiratory protection** A full face piece respirator with an external pre-fitted filter for particulates in combination with an organic vapour class 1, 2 or 3 gas filter. This will also protect eyes. **Skin protection** Full skin cover including: • Disposable overalls • Head covering (as needed) • Gloves – check SDS • Boots • Disposable boot protective covers
Outdoors	**Respiratory protection** A full face piece respirator with an external pre-fitted filter for particulates in combination with an organic vapour class 1, 2 or 3 gas filter suitable for the . This will also protect eyes. When spraying isocyanate containing paints and coatings, an air supplied respirator is required. **Skin protection** Determined by risk assessment.

POTENTIALLY HAZARDOUS PROCESSES
ABRASIVE BLASTING

REFERENCE: ABRASIVE BLASTING CODE OF PRACTICE 2013

Abrasive Blasting

Abrasive blasting is used in a wide range of industries for many different purposes, including the removal of rust, scale, paint, graffiti, mildew, and various forms of surface preparation. Abrasive material is propelled onto the surface at a high speed using air pressure, water pressure or centrifugal force.

The most common method of abrasive blasting uses compressed air to propel abrasive material from a blast pot, through a blasting hose to a nozzle that is manually controlled by the operator. Blasting is done in commercial built blast rooms, blasting yards or inside temporary enclosures, erected on site. Other methods use wet abrasive blasting or water jetting with or without an abrasive. Automated abrasive blasting machines such as centrifugal wheels and tumblers are also occasionally used.

HAZARDS ASSOCIATED WITH ABRASIVE BLASTING

The major hazards that have been identified as being associated with the activity of abrasive blasting are:

- Crystalline silica
- Noise
- Particulate matter
- Lead

Other hazards include manual handling, slips, trips, falls, working in confined spaces, working on elevated work platforms, heat and vibration. For the purposes of this course, only the hazards associated with silica dust and particulate matter will be covered as all other hazards are covered throughout various sections of the course.

Section 381 of chapter 7 of the *Work Health and Safety Regulation 2011* prohibits and restricts the use of some hazardous chemicals as abrasive material in an abrasive blasting process.

The following table indicates blast material that should not be used and blast media that could be substituted:

Restricted hazardous chemicals
Any substance that contains greater than: • 1 % free silica (crystalline silicon dioxide) • 0.1% antimony • 0.1% arsenic • 0.1 % beryllium • 0.1 % cadmium

- 0.5 % chromium (except as specified for wet abrasive blasting)
- 0.1 % cobalt
- 0.1 % lead (or which would expose the operator to levels in excess of those set in the WHS Regulation covering lead)
- 0.1 % nickel
- 0.1 % tin
- any radioactive substance where the level of radiation exceeds 1 becquerels per gram (Bq/g), so far as reasonably practicable.
- For wet abrasive blasting, any substance than contains chromate, nitrate or nitrite
- Polychlorinated biphenyls (PCBs)

Dust

One of the main hazards in abrasive blasting is dust which in many cases can be toxic. Crystalline silica and lead are typical examples of toxic dusts that can be generated during abrasive blasting activities.

Crystalline silica

Crystalline silica dust can be generated by:

- using abrasive materials that contain traces of crystalline silica, (e.g. staurolite or garnet), or

- abrasive blasting surfaces that contain crystalline silica (e.g. concrete, sandstone masonry, calcium silicate bricks, foundry castings).

Exposure to respirable crystalline silica can result in silicosis, which is stiffening and scarring of the lungs. It results in shortness of breath, coughing, and chest pain. The effects are irreversible and lead to a degeneration in the person's health, invariably resulting in death. Exposure to respirable crystalline silica is also associated with chronic lung diseases and cancer.

Silicosis can result from short-term exposure to high concentrations of crystalline silica dust (acute silicosis) or it can develop after long-term exposure over a number of years.

Lead dust

Lead dust can be generated by:

- using an abrasive material that contains lead (prohibited under the WHS Regulation)

- the abrasive blasting of surfaces containing lead, or

- abrasive blasting surfaces covered by paint that contains lead.

These surfaces commonly occur on bridges, ships, machinery, vehicles and recycled old housing timber.

Lead is easily absorbed or taken into the body by:

- inhaling dust or fumes
- eating contaminated food
- eating, drinking or smoking using contaminated fingers.

The major risk associated with lead is lead poisoning (plumbism). This affects the blood system and can cause anemia. Other symptoms include abdominal pain, convulsions, hallucinations, coma, weakness, tremors and the possible increased risk of cancer. Lead exposure can also affect both male and female reproductive systems. A developing foetus is particularly at risk, especially in the early weeks before a pregnancy becomes known.

The rate of absorption of lead depends on the size of the particles and the route of entry. Abrasive blasting produces particles small enough to be absorbed rapidly, leading to more acute and severe toxic effects.

CONTROL OF DUST

ELIMINATION

Using a less hazardous abrasive material

Before purchasing any abrasive blasting mediums, you should look at the label and SDS to check the concentration of impurities and whether its use is prohibited or restricted under the WHS Regulation. Where a material is prohibited from use, your supplier may be able to advise alternative abrasive blasting medium (see Appendix A).

It is important to select an abrasive blasting medium with qualities that will generate minimum dust levels. Metallic abrasives have proven characteristics that resist shattering on impact, which is the major cause of the dust produced during blasting. Environmentally clean and recyclable abrasives, such as chilled iron grit or cast steel grit, should be used where reasonably practicable.

SUBSTITUTION

The selection of methods of surface preparation can also affect the amount of dust in the air.

Wet abrasive blasting

A standard blast machine and compressed air are used to propel the abrasive with just enough water added to suppress the dust. Inhibitors are sometimes added to the water to minimise flash rusting. For effective dust suppression, the water should be added before the abrasive leaves the nozzle. The use of inhibitors such as chromate, nitrate or nitrite must comply with the restrictions on use in Table 10.3 of Schedule 10 of the WHS Regulation.

Water jetting (high and ultra high pressure)

High pressure water jetting is an alternative method to abrasive blasting. For further information on high pressure water jetting you should refer to AS/NZS 4233.1 *High pressure water (hydro) jetting systems Part 1:– Guidelines for safe operation and maintenance* and AS/NZS 4233.2: *High pressure water (hydro) jetting systems Part 2:- Construction and performance*.

Centrifugal wheel blasting

Centrifugal wheel blasting involves a rotating wheel assembly, either air or electrically driven, inside an enclosure fitted with a dust collector. Abrasive is propelled outwards from the spinning wheel by centrifugal force, striking the surface to be cleaned and removing rust, paint and mill scale.

Abrasives used include steel shot, steel grit, cut wire and chilled iron grit. They are recyclable and are continuously recovered, cleaned and returned for re-use.

Centrifugal wheel blasting is normally used where the work is of a consistent size, (e.g. pipes, valves, or steel sections). Normally, the rotating wheel assembly remains fixed and the surface to be cleaned is passed through the enclosure, but centrifugal wheel blasting can also be used on-site, (e.g. on a tank), with special adaptors where the wheel assembly moves across a stationary work surface.

Because all blasting takes place within an enclosure, there is no contact with airborne dust or high velocity particles. This minimises the risk to operators. However, attention should be paid to seals on wheel abrading equipment to ensure that toxic dusts cannot escape into the workplace during operation and that sufficient extraction clearance time is allowed before access doors are opened.

Vacuum blasting

Vacuum blast cleaning uses a standard abrasive blast nozzle, operating inside a shroud which is in close contact with the work surface, forming a tight seal. As the abrasive impinges on the surface, a vacuum is applied inside the shroud, removing the debris. The abrasive material, which typically can be steel shot, steel grit, chilled iron grit, aluminium oxide or garnet, is separated, and returned for re-use.

A variety of heads may be used to achieve a tight seal for inside corners, outside corners, and flat surfaces. In practice, however, operators tend not to change heads, lifting the assembly from the surface to clean odd shapes and inaccessible surfaces. While this may save time, it breaks the seal, defeating the purpose of the vacuum and exposing workers and the environment to hazards. This practice should be avoided where possible.

When used properly, vacuum blast cleaning can clean effectively with minimal dust generation.

Other removal methods

There are many emerging techniques and equipment that may minimise airborne dust levels. These include:

- sodium bicarbonate blasting
- blast cleaning with reusable sponge abrasives
- carbon dioxide (dry ice) blast cleaning.

You should also consider cleaning techniques that do not involve blasting, particularly for smaller jobs. These include:

- chemical strippers
- heat guns

- power tools with dust collection systems
- manual sanding
- scraping.

Although these techniques should generate low levels of dust, and therefore generally present lower risks to workers than abrasive blasting, other risks involved in using such techniques still need to be assessed and controlled.

ISOLATION AND ENGINEERING CONTROLS

This may be achieved, where practical, by the use of blast cabinets or chambers.

ADMINISTRATIVE CONTROLS

Administrative controls include exclusion zones, scheduling abrasive blasting activities, housekeeping, training and the provision of suitable amenities.

The size of the exclusion zone should be determined after assessing the risk to all unprotected people. The prevailing conditions at the time of blasting should be taken into account, for example, the exclusion zone may need to be extended down-wind.

An exclusion zone should be established and maintained to exclude workers and other persons who are not wearing respiratory protective equipment (RPE). Warning signs should be located so that they are clearly visible before entering the area to warn workers and other that:

- abrasive blasting is in progress
- there is a silica dust hazard
- access to the work area is restricted to authorised persons
- respiratory protection must be worn in the work area.

With scheduling abrasive blasting activities, there are a number of options:

- Shifting the site of abrasive blasting away from other workers
- Scheduling blasting outside normal working hours
- Not blasting in windy conditions
- Stopping other work from a site and clearing people whilst blasting is taking place
- Limiting individual operator time by job rotation.

PERSONAL PROTECTIVE EQUIPMENT

Workers engaged in abrasive blasting should be supplied with and wear an airline positive pressure hood or helmet fitted with an inner bib and a high visibility shoulder cape, jacket or protective suit.

Respirator helmets must be supplied with breathing air of an adequate quality. If the air is supplied from compressed air cylinders, the source should be fitted with an alarm device that warns the wearer or an attendant when the cylinder pressure falls below a predetermined level.

For information on air quality refer to *AS/NZS 1715: Selection, use and maintenance of respiratory protective equipment.*

PARTICULATE MATTER

Particulate matter includes small particles of the object being blasted, or of the abrasive material. Particulate matter can also include water. Particulate matter can strike workers carrying out abrasive blasting.

Health Effects

Serious injuries or deaths can result from being struck by particulate matter discharged under high pressure. Common injuries include:

- Eye damage
- Severe lacerations
- Burns
- Skin penetration

CONTROL MEASURES

Isolation

Abrasive blasting activities should be isolated from other workplace activities to reduce the possibility of workers being struck by particulate matter. This can be done by blasting chambers, blasting cabinets, temporary enclosures and exclusion zones.

Abrasive blasting plant can also incorporate guards to reduce the possibility of particulate matter striking the operator.

Engineering controls

The engineering controls such as self-actuating cut-off devices, hose whip checks and hose coupling safety locks, can be incorporated into the design of the abrasive blasting unit. The self-actuating cut-off devices act as a "deadman control" which cuts air supply off and prevents the whipping of the hose when the nozzle is dropped.

Administrative controls

The administrative controls to reduce the hazards associated with particulate matter are:

- When blasting, the nozzle should only be pointed at the work
- Blast hoses should be uncoiled when in use
- Blasting personnel should be adequately trained in the use and maintenance of the equipment, including personal protective equipment

PERSONAL PROTECTIVE EQUIPMENT

Workers exposed to high velocity particulate matter should wear suitable personal protective equipment to protect against ricocheting abrasive. This may include:

- Eye protection
- Protective gloves (canvas or leather)
- Protective footwear
- Respiratory equipment
- Protective clothing (overalls, long trousers, blast suits, aprons)

Note about compressors powered by internal combustion engine used to supply breathing air:

- There is an inherent risk that the air supplied can be contaminated with harmful gases and substances including carbon monoxide.
- When air compressors powered by an internal combustion engine continue to operate when overheated, there is a risk the engine oil burning and producing excessive amounts of carbon monoxide.
- Exposure to carbon monoxide in this way has resulted in operator deaths.
- Make sure to supply a breathing air system that is designed for safe use with supplied air respirators. A compressor used to supply industrial air may not be suitable for breathing air.

Periodically test the air quality. This should include installing a continuously operating carbon monoxide monitor with an alarm in a position as close to the user as possible on oil-lubricated compressors.

ABRASIVE BLASTING PLANT AND EQUIPMENT

Regular inspection and maintenance is particularly important for abrasive blasting plant and equipment as the process is self-destructive by nature. Every blasting chamber, blasting cabinet, ventilating system duct, filtering or cleaning device and item of abrasive blasting equipment should be inspected by a competent person in accordance with the manufacturer’s instructions. In addition, plant and equipment should be checked daily by the operator for wear and damage. Owners of plant and associated equipment should keep log books and inspection check sheets containing a fully history of service and repairs.

When purchasing plant and equipment you should also ensure that safety features have been incorporated into the design.

Abrasive blasting plant and equipment should only be operated by trained people.

Nozzle

- Where dry blasting is being conducted, an efficient means for the discharge of static electric charge from the blast nozzle and the object being blasted must be provided.
- Abrasive blasting equipment must be fitted with a self-actuating cut-off device (deadman control) under the direct control of the nozzle operator which can quickly stop the flow of abrasive material to the nozzle.

Deadman Controls

- Deadman controls must be located near the blast nozzle so that they can be readily accessed by the nozzle operator.
- Deadman controls can be either pneumatic or electric. Pneumatic controls are only suitable for distances up to 40 metres because the response time increases with distance.
- Deadman controls (especially the lever and lever lock) should be inspected and tested several times each working day. The moving parts should be cleaned regularly to prevent jamming and the rubber buttons and seals should be replaced frequently to prevent air escaping and abrasive from entering.
- Never tape down or prevent free movement of the control handle.

Blast Hoses, Hose Whips and Couplings

- Never exceed a blast hose’s rated working pressure.
- The hose from the pot to the blast nozzle should be kept as straight as possible. In situations where a hose needs to be curved around an object, a long radius curve should be used. The use of sharp curves may create rapid wear on the hose, leading to the possibility of the hose malfunctioning.
- Do not blast with a coiled hose.
- Hose whip checks or hose coupling safety locks or both must be fitted to hoses.

Blasting Cabinets

- Suitable for small objects.
- Cabinets should be constructed from an abrasive resistant material.
- They should have a sealed window so that the operator can view the object being cleaned.
- They should be fitted with a dust extraction/collection system which has a sufficient air change rate to increase visibility and keep dust exposures less than the national exposure limits when the cabinet is opened.
- In conjunction with the air change rate, a suitable cleaning time should also be allowed before opening the cabinet.
- Cabinets should have a dust tight light fixture.
- Doors should be interlocked to eliminate the possibility of the machine being operated while the door is open.
- Cabinets should be regularly inspected and maintained especially in relation to gloves, gasket, door seals and structural integrity.

Blasting Chambers

- Blasting chambers must be constructed from an abrasive resistant, non-combustible material, designed to prevent the escape of dust and minimise internal projections on which dust may settle.
- They must have windows or inspection ports which are fixed in a metal sash and constructed of toughened safety glass, laminated safety glass or safety wired glass complying with AS/NZS 2208 Safety Glazing Materials in Buildings. Windows or inspection ports must be maintained so as to allow effective visibility.
- They must have an emergency exit located at the furthermost position from the main entrance.
- They must be fitted with a mechanical dust extractor/collection system which provides an air velocity which ensures: good visibility; prevents dust settling and accumulating in the chamber; and reduces dust concentrations so PPE can provide adequate protection. This system should also have ducting fitted with inspection and cleaning ports where dust can accumulate.
- They must have an apparatus to separate the abrasive from the dust and to prevent the abrasive from being reintroduced into the blasting apparatus until it has been separated.
- They must have an illumination of at least 200 lux measured on a horizontal plane one metre above the floor of the blasting chamber or enclosure.
- They must have an electrical supply which complies with AS2381 Electrical Equipment for Explosive Atmospheres – Selection, Installation and Maintenance and AS3000 Electrical Installations – Buildings, Structures and Premises (known as the SAA Wiring Rules).
- They should be equipped with easily accessible operating controls.
- Blasting chambers must be maintained so as to prevent dust from escaping.
- Doors must be kept closed during blasting.
- Doors should be interlocked to eliminate the possibility of the machinery being operated while the door is open.
- Only abrasive blasting work, work incidental to abrasive blasting, or maintenance or repairs to the blast room or its equipment are to be conducted in the blasting room.
- Ventilation systems must be operated continuously while blasting is being done, for at least five minutes after blasting has finished and during blow-down subsequent to the blasting process.
- Manufacturers of blasting chambers should conduct testing to ascertain the level of ventilation required under normal operating conditions. This should assist you to select a chamber appropriate to your needs.
- Monitoring should be conducted on-site when the chamber is installed to ensure that its operating performance under normal operating conditions is sufficient to prevent exposure above national exposure limits.
- Monitoring should also be conducted where there has been a change in blasting procedures (e.g. use of a different abrasive material) after damage or repairs and on a regular basis (e.g. every 12 months). This monitoring can be conducted by an occupational hygiene consultant.

Temporary Enclosures

- Where full enclosure is not possible, screening should extend 2 metres above the structure and blasting should be conducted downwards. Stringent monitoring should be used to ensure that people outside the structure are not exposed to dust levels greater than national exposure standards. Where monitoring shows levels are high, exclusion zones and PPE should be used.
- Containment screens should be made of puncture and tear resistant materials such as woven polypropylene fabric or rubber for high abrasion areas inside the enclosure.
- Temporary enclosures should be fitted with a dust extraction/collection system.

Version	Date	Author
1	30/06/2018	WHSQ