Abrasive Blasting Code of Practice 2004

Workplace Health and Safety Queensland

Department of Justice and Attorney-General

Queensland Government

Abrasive Blasting Code of Practice 2004

Important information about the code

1. The code was made on 24 June 2004.
2. The code commenced on 1 July 2004.
3. The code was amended on 28 April 2006 and 5 December 2008.
4. The code expires 10 years after it commenced.

What is this code of practice about?

The purpose of the Abrasive Blasting Code of Practice is to give practical advice about ways to manage exposure to risks identified as typical in abrasive blasting and associated protective coating work.

Workplace Health and Safety Obligations and the *Workplace Health and Safety Act 1995*

The *Workplace Health and Safety Act 1995* imposes obligations on people at workplaces to ensure workplace health and safety. Workplace health and safety is ensured when persons are free from death, injury or illness created by workplaces, relevant workplace areas, work activities, or plant or substances for use at a workplace. Ensuring workplace health and safety involves identifying and managing exposure to the risks at your workplace.

Obligations of a person who conducts a business or undertaking (a 'relevant person')

The *Workplace Health and Safety Act 1995* places obligations on a person who conducts a business or undertaking. The Act refers to a person who conducts a business or undertaking as a 'relevant person'. The obligations apply whether or not:

- the relevant person conducts the business or undertaking as an employer, self-employed person or otherwise
- the business or undertaking is conducted for gain or reward, and
- a person works on a voluntary basis.

'Relevant persons' have an obligation to ensure:

- the workplace health and safety of their workers and any other persons is not affected by the conduct of the relevant person's business or undertaking
- their own workplace health and safety.

The term 'relevant person' is also used in the *Workplace Health and Safety Regulation 2008*.

Where this code of practice provides advice to employers and self-employed persons on managing exposure to risks, other persons who conduct a business or undertaking may also find this advice applicable depending on their circumstances.

How can I meet my obligations?

Under the Act, there are three types of instruments to help you meet workplace health and safety obligations – regulations, ministerial notices and codes of practice.

If there is a regulation or ministerial notice about a risk, you MUST do what the regulation or notice says.

If there is a code of practice about a risk, you MUST either:
(a) do what the code says
(b) do all of the following:
- adopt and follow another way that gives the same level of protection against the risk
- take reasonable precautions
- exercise proper diligence.

If there is no regulation, ministerial notice or code of practice about a risk, you must choose an appropriate way to manage exposure to the risk and take reasonable precautions and exercise proper diligence to ensure that your obligations are met.

Note

There may be additional risks at your workplace which have not been specifically addressed in this code of practice. You are still required under the Act to identify and assess these risks and ensure that control measures are implemented and reviewed to eliminate or minimise exposure to these risks. The risk management process section contains information on how to carry out a risk management process for risks which have not been specifically covered by this code of practice.

Contents

Introduction

If you work in the abrasive blasting and protective coating industry, this code of practice will help you meet your workplace health and safety obligations as required under the *Workplace Health and Safety Act 1995*.

This code of practice provides information on:

- hazards and risks in abrasive blasting and associated protective coating work control options for dealing with these hazards and risks
- a list of useful references, and
- information on how to conduct a risk management process at your workplace.

The control measures in this code of practice are presented by a hierarchy of control. This is an order which tells you which of the control measures provides a better level of risk control. You should use control measures which are presented first, wherever possible.

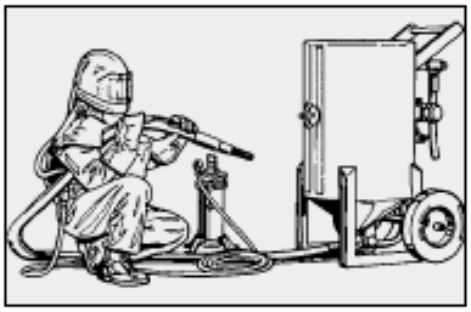
Below is a table which lists out the various levels of the hierarchy.

1. Elimination	**The most desirable option.** If you eliminate a hazard you completely eliminate the associated risk.
2. Substitution	You can substitute something else (a substance or a process) that has less potential to cause injury.
3. Isolation / Engineering	You can make a structural change to the work environment or work process to interrupt the path between the worker and the risk.
4. Administrative	You may be able to reduce risk by upgrading training, changing rosters, or other administrative actions.
5. Personal protective equipment	**The least desirable option.** When you can't reduce the risk of injury in any other way, use personal protective equipment (gloves, goggles, etc.) as a last resort.

In practice, several control options are often used in combination. This is particularly true in abrasive blasting, with personal protective equipment usually used in conjunction with other control measures.

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 on to the surface at 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 commercially 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 wheel systems and tumblers are also occasionally used.

Protective coating

The application of a protective coating goes hand in hand with abrasive blasting, and is done mainly to protect metal surfaces from corrosion, or to improve the appearance of a product. There are many types of finishing methods, usually dependent upon the type of paint selected and the manufacturer's recommendations for application.

Protective coatings can be applied to newly-blasted surfaces by brush, roller, dipping or spray painting. Spray painting, (including conventional air spray, airless atomisation and air assisted airless atomisation) is the usual method.

Part A – Hazards of abrasive blasting processes

Dusts

Abrasive blasting can generate large quantities of dust, which may be toxic.

There are a number of factors that affect the degree of risk associated with dust produced in abrasive blasting work. These factors include:

- the abrasive medium used
- the surface being treated
- the concentration of airborne dust in the breathing zone of the worker
- the size of the dust particles generated
- whether dust particles are inspirable or respirable
- whether blasting is carried out in a confined space
- how easily the abrasive material breaks down
- the duration of exposure, and
- the individual responses to exposure - some individuals may be more affected than others due to differences in their biology or lifestyle.

Inspirable dust is any dust which can be inhaled.

Respirable dust is only that dust which is small enough to be inhaled into the lungs. This sort of dust can result in permanent scarring of the lung tissue. Abrasive blasting results in high concentrations of respirable dust.

Toxic dusts
Many types of abrasive materials produce toxic dust and you must assess the degree of risk associated with each material.

Silica dust and lead dust are typical examples.

Silica dust
Silica dust can be generated by:
- using abrasive materials that contain silica, e.g. river sand, beach sand or quartz rock, and
- abrasive blasting surfaces that contain silica – e.g. concrete, sandstone masonry, calcium silicate bricks.

Exposure to silica dust can result in silicosis, a 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.

Silicosis can result from either a single exposure (acute silicosis) or it can develop over a number of years. Inhalation of silica dust may also lead to the development of some forms of cancer.

Lead dust
Lead dust can be generated by:
- using an abrasive material that contains lead
- the abrasive blasting of surfaces containing lead, and
- abrasive blasting surfaces covered by paint that contains lead.

These surfaces commonly occur on bridges, ships, and vehicles.

Lead is a hazardous substance that is easily taken into the body by:
- inhaling dust or fumes
- eating contaminated food, and
- smoking with contaminated fingers.

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

The major risk associated with lead is lead poisoning (plumbism). This effects the blood system and can cause anaemia. Other symptoms include abdominal pain, convulsions, hallucinations, coma, weakness, tremors, and reduced fertility.

Managing risks from dusts

The first thing you should do when managing the risk from dusts at your workplace, is to conduct a risk management process. This means:

- identify sources of dusts
- assess dusts levels
- evaluate the risk to exposed workers and other persons, and
- decide what control measures, health surveillance and monitoring is required.

Air monitoring is a relatively simple and inexpensive method of assessing the risks from dust. You should conduct air monitoring when you start a job to ensure that you are aware of the risks of that particular situation. This information is important for helping you to decide which control measures are most appropriate for that particular job.

Air monitoring should also be conducted at regular intervals over the job to ensure the control measures you have chosen are still effective. More information on how to conduct air monitoring is covered under review of control measures later in this section.

Control measures

Some control measures that you can introduce to reduce the exposure of workers to risk from dust include:

- substituting a less hazardous abrasive material
- substituting a less hazardous surface preparation method
- isolation / engineering controls
- administrative controls, and
- personal protective equipment.

The workplace health and safety legislation places certain obligations on manufacturers, importers, suppliers and employers in relation to the provision of adequate information about the safe use of substances used at a workplace. This information will assist you to select the appropriate control measures.

Any abrasive material you choose to use will fall into one of 3 categories that have specific requirements under workplace health and safety legislation. These are:

- a ‘hazardous substance’ as defined under Part 16 of the *Workplace Health and Safety Regulation 2008*
- a ’lead hazardous substance’ as defined under Part 17 of the *Workplace Health and Safety Regulation 2008*, and
- or if it isn't either of these, it will still be a ’substance’ under section 34 of the *Workplace Health and Safety Act 1995*.

Depending on the category under which the abrasive medium falls, there are certain things that the manufacturer / importer, your supplier and you MUST do in relation to information about the abrasive material.

1. For a ‘hazardous substance’:
Manufacturers or importers must:

- prepare the Material Safety Data Sheet (MSDS) before first manufacturing or importing the substance (or if this is not practicable, as soon as practicable after first manufacturing or importing the substance)
- amend the MSDS when necessary to keep it current
- review the MSDS every five years, and
- provide a copy of the MSDS when first supplying the product or on request.

Suppliers must:
- provide you with a copy of the current MSDS when first supplying the substance or on request, and
- label containers appropriately.

Employers or self-employed persons must:
- ask the supplier if an abrasive medium is a hazardous substance
- ask for a copy of the current MSDS
- keep a register, that is a list of hazardous substances used and current MSDS's
- keep a copy of the MSDS close to where the substance is being used
- label containers appropriately
- conduct a hazardous substances risk assessment
- keep a record of the risk assessment
- prevent exposure if possible or reduce to as low as is practicable but no higher than the national exposure standard
- if necessary, conduct monitoring and health surveillance, and
- provide adequate induction and training to workers.

You will need to consult Part 16 – *Hazardous Substances*, of the *Workplace Health and Safety Regulation 2008* for more detail on the legislative requirements for hazardous substances.

2. For a 'lead hazardous substance':
Similar requirements apply for a lead hazardous substance. However, for lead there are additional requirements which include issues such as removal from and return to a lead risk job, breast feeding and pregnancy.

You will need to consult Part 17 – *Lead*, of the *Workplace Health and Safety Regulation 2008* for more detail on the legislative requirements for lead hazardous substances.

3. For a 'substance'
If the abrasive material is not a 'hazardous substance' or a 'lead hazardous substance', it will still be a 'substance' under section 34 and 34A of the *Workplace Health and Safety Act 1995*. These sections apply to manufacturers, importers and suppliers.

Manufacturers, importers and suppliers must:
- ensure appropriate levels of testing and examination are carried out to ensure the substance is safe and without risk to health when used properly,
- ensure appropriate information about the safe use of the substance is available including precautions for safe use, health hazards and any test results relevant to its safe use, and
- take reasonable action to prevent the use of an unsafe substance at a workplace.

Substituting a less hazardous abrasive material

Table 1 lists abrasive blasting materials which you should avoid because their use is likely to result in exposures which exceed national exposure limits. The table also gives some examples of blasting media which will in most cases be acceptable for use. This table is not exhaustive, and you should check with your supplier about the content of any abrasive material that you are planning to use.

Table 1 - Selecting an abrasive blasting medium

Blast media which should not be used	Blast media which could be substituted
In dry abrasive blasting: • Materials containing more than 2% crystalline silicon dioxide • Recycled materials which have not been treated to remove respirable dust • Materials likely to harm the upper respiratory tract **In general abrasive blasting:** • Materials containing a radioactive substance as stated in the '*Radiation Safety (Radiation Safety Standards) Notice 1999* or the *Radiation Safety Regulation 1999*' • Materials containing more than: - 0.1% antimony - 0.1% arsenic - 0.1% beryllium - 0.1% cadmium - 0.5% chromium - 0.5% cobalt - 0.1% lead - 0.5% nickel • River sand • Beached sand • other white sand • quartz rock dust • Diatomaceous earth (pool filter material) • Some metal slags (check the content analysis before purchase)	The following materials will not usually result in exposures greater than national exposure limits when using a blast helmet with supplied air. • ilmenite • aluminium oxide • garnet • other rocks and mineral sands containing less than 2% silica • metal shot • steel grit • crushed glass • sodium bicarbonate • some metal slags (check content analysis before purchase) **Note 1: There are environmental requirements in relation to abrasive blasting materials. If in doubt, seek advice from your local council.** **Note 2: There are also health requirements in relation to the use of radioactive substances. For more information, contact Radiation Health Unit Queensland Health.** **Website:** **www.health.qld.gov.au/phs/ehu/radiation.htm**

It is important to select an abrasive blasting media with qualities that will generate minimum dust levels. Metallic and garnet 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 garnet, chilled iron grit or cast steel grit should be used where feasible.

Substituting a less hazardous surface preparation method

You may select alternative methods of surface preparation that will reduce the amount of dust in the air.

These include:

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. Inhibitors must not contain chromate, nitrate or nitrite.

High pressure water jetting
High pressure water jetting (greater than 20 500 kPa but less than 172 500 kPa, 3,000 to 25,000 psi) utilises a pressure pump, a large volume of water, a specialised lance and nozzle assembly, and in some cases, inhibitor to prevent flash rusting. High pressure water can remove loose paint and rust but will not efficiently remove tight paint, tight rust, or mill scale.

It does not create a profile on its own, but if the original surface was blast cleaned, the old paint can be removed to expose the original profile.

Ultra high pressure water jetting
This utilises pressurised water from 172 500 kPa to 257 800 kPa, 25,000 to 40,000 psi (or higher). Ultra high pressure water jetting is similar to high pressure water jetting (see above) except that higher pressures clean much more efficiently and are better able to remove tight rust and paint. Mill scale is not removed.

Water jetting (high and ultra high pressure) with abrasive injection
The ability of water jetting to remove tight paint, rust and mill scale can be much improved if an abrasive is injected into the water stream at the nozzle. The quality of preparation can be improved and profile is imparted to the surface.

The disadvantage of any wet blasting process is that the wet abrasive and paint residue may be difficult to clean from the surface and recover. If inhibitors are used to minimise flash rusting, take care, some may be toxic or interfere with subsequent coatings. Inhibitors containing chromate, nitrate or nitrite must not be used in wet abrasive blasting.

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.

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 creating health and environmental hazards.

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 reduce airborne dust levels.

These include:
- sodium bicarbonate blasting
- blast cleaning with reusable sponge abrasives, and
- carbon dioxide (dry ice) blast cleaning.

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

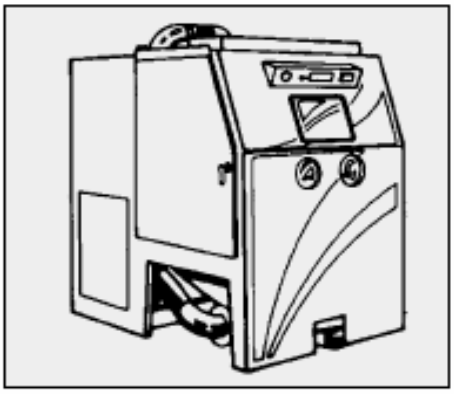
These include:
- stripping with non-toxic chemical strippers
- heat guns
- power tools with dust collection systems
- manual sanding, and
- scraping.

These techniques may produce little or no dust and present a relatively low level of risk in regard to other hazards (e.g. chemicals, fumes).

Isolation/engineering controls

Blasting cabinets
These are suitable for blasting small objects. The cabinet is fully sealed and the operator manipulates the work piece and the blasting hose from outside, viewing the object through a sealed window.

When using a properly designed and maintained cabinet, there is no need to wear a respiratory device. However, a low toxicity abrasive should still be used as poor maintenance may expose workers to dust. Further information on blast cabinets can be found in the section on abrasive blasting plant and equipment.

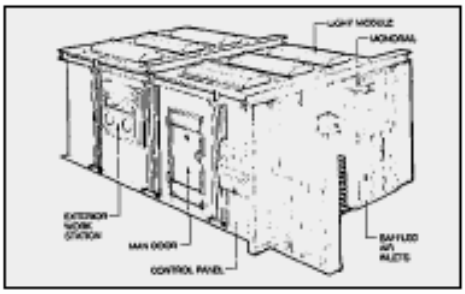


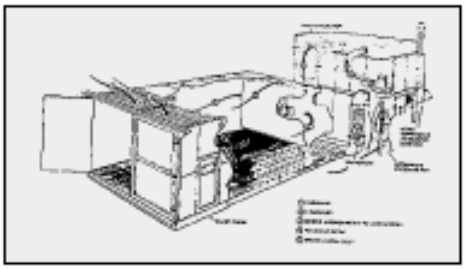
Blasting chambers
Blasting chambers (also known as blast rooms) should be used for cleaning transportable objects that are too large to be treated inside a blasting cabinet.

Objects can be transported to the blasting position by a fork-lift truck or a flat-bed rail car. Blasting is done manually by an operator (or operators) working inside the chamber.

Operators working inside blasting chambers must wear a hood or helmet type airline respirator complying with *AS/NZS 1716 Respiratory protective devices* fitted with an inner bib and a shoulder cape, jacket or protective suit.

Further information on blasting chambers can be found in the section on abrasive blasting plant and equipment



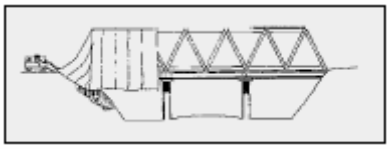


Temporary enclosures
Temporary enclosures should be used when the object or structure is unable to be transported. Any object measuring greater than 2.5m X 2.5m X 3.0m can be considered large. Temporary enclosures are also used for fixed structures, e.g. bridges or water tanks.

Where monitoring indicates that persons in surrounding areas may be exposed to dust levels in excess of the national exposure standards, they should be excluded from the area, where possible, by warning signs and barricading, or provided with personal protective equipment (PPE).

Further information on temporary enclosures can be found in the section on abrasive blasting plant and equipment.

Exclusion zones



Although open air blasting activities are not recommended, there may sometimes be no alternative. In these circumstances, exclusion zones (also known as buffer zones) may be used to protect workers and other people in the vicinity from exposure to hazardous dust levels that are above national exposure limits.

Exclusion zones may also be used in conjunction with blasting chambers and temporary enclosures.

The extent of the 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 so as to exclude all people who are not wearing respiratory protection. Warning signs in accordance with *AS 1319 Safety signs for the occupational environment* should be posted so that they attract attention and are clearly visible before entering the area.

Signs should warn that:

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

Where an exclusion zone interferes with other activities at a workplace, other workers should only work within the exclusion zone after being provided with respiratory protection equipment as outlined in *AS/NZS 1716 Respiratory protective devices*.

Recycling

The recycling of blast media involves three stages - collection, cleaning and reuse of spent material that contains some useable abrasive grains. During abrasive blasting, the spent material has endured high velocity impact with the surface being cleaned, producing shattered abrasive and dust, combined with particles of the material being removed. The recycling process separates these and allows the recovered abrasive to be reused efficiently and safely without increase in dust levels. Abrasive that has become wet cannot be recycled as dust separation is not possible.

1. Collection

Collection of the spent media from the blasting site is best done with a method that least disturbs the spent material. Vacuum recovery equipment offers the best protection for the operators. Using methods that generate dust (e.g. sweeping or compressed air blowdown) should be avoided.

2. Cleaning

The following contaminants should be extracted before the blast media is reused:

- oversized trash - all particles (e.g. rust, paint flakes and other foreign matter) that are of sufficient size to clog the blast machine metering valve or nozzle
- toxic dust - any toxic contaminants that have been introduced or released into the media e.g. lead from lead paint material
- nuisance dust - fine shattered abrasive grains, and
- respirable dust - powdered material that is respirable and will penetrate the lower respiratory system.

3. Reuse

The collected material will contain various contaminants (see above) as well as the reusable abrasive grains. The contaminants must be separated from the media by passing though engineered equipment including airwashes, cyclones and screens as required, before it can be returned to the blast machine for reuse.

Administrative controls

Scheduling abrasive blasting activities

The number of people who will be exposed to dust and the time for which they may be exposed should be reduced by:

- shifting the site of abrasive blasting away from other workers
- scheduling blasting outside normal working hours
- not blasting in windy conditions
- stopping other work on a site and clearing people while blasting is taking place, and
- limiting individual operator time by rob rotation.

Housekeeping

Drift from abrasive blasting can be harmful not only to workers but also to members of the public. Good housekeeping can minimise the risk of exposure.

While other control measures should prevent dust escaping from the area where blasting is being done, any dust or residue that does make its way into the workplace should be cleaned as soon as practical after blasting has finished. Where practical, accumulated dust should be removed using wet cleaning methods, or High Efficiency Particulate Air (HEPA) filter vacuum methods (see *AS 3544 Industrial vacuum cleaners for particulates hazardous to health*).

Because workers undertaking cleaning work may be exposed to dust levels in excess of the exposure standard, they should wear personal protective equipment.

Training

Proper training in selection of appropriate equipment and safe working methods can reduce risk. Induction and ongoing training must be given to any worker exposed to risks from dust.

The training should be appropriate to the level of risk, as identified by a risk assessment. As a minimum, workers should be adequately trained in safe methods of work, use of plant and equipment including the correct use, storage and maintenance of respiratory and other personal protective equipment.

Amenities
Many types of dust (particularly lead dust), may enter the body by ingestion, so risk will be minimised by taking care with personal hygiene.

Amenities should be provided to allow workers to:
- shower after the completion of blasting
- change clothes at the completion of blasting, and
- wash hands and face prior to eating, drinking or smoking.

Personal protective equipment (PPE)

Respiratory protection
Workers engaged in abrasive blasting must be supplied with and must wear an airline positive pressure hood or helmet complying with *AS/NZS 1716 Respiratory protective devices*, fitted with an inner bib and a shoulder cape, jacket or protective suit. To keep out dust and abrasive grit, protective suits or clothing should also have leather or elastic straps at the wrist and ankles, and overlapping flaps at all suit closures.

An air purifying respirator complying with *AS/NZS 1716 Respiratory protective devices* must be worn by the pot attendant or any other person within the work area while abrasive blasting is in progress, during maintenance or repair work, where dust from the process is visible or during the clean-up of dust.

Air monitoring by trained personnel should be conducted in all abrasive blasting applications as part of the initial risk assessment process. This will enable the appropriate respirator to be selected and will ensure that workers and other people are not exposed to harmful dust concentrations.

The selection, use and maintenance of respiratory devices should be undertaken in accordance with *AS/NZS 1715 Selection, use and maintenance of respiratory protective devices*.

Respirators will only provide a satisfactory level of protection when they are selected, fitted, used and maintained according to the manufacturer's written instructions and other regulatory and advisory guidelines. PPE should be individually fitted and if it is to be shared, it should be disinfected and refitted before use.

A checklist of requirements for PPE used in abrasive blasting, including respirators, can be found in the section on abrasive blasting plant and equipment.

Review of control measures

After selecting and implementing the control options, the effectiveness of the controls used for managing exposure to toxic dusts should be checked by:

- atmospheric testing, and
- health surveillance.

Atmospheric testing

Although it is not practical to measure exposure in the breathing zone of an operator wearing respiratory protection, it is relatively simple and inexpensive to test in the atmosphere surrounding the abrasive blasting site, to ensure that others working close to the abrasive blasting area are not adversely exposed to dust generated by the process.

Atmospheric testing can be used to check the effectiveness of the control measures being used to prevent or minimise exposure to dust and may also be used at the commencement of the job to select appropriate control measures. Atmospheric testing is particularly important in measuring exposure when a toxic material is introduced into the blasting process.

There are four main parts to conducting atmospheric testing:

1. Collect an air sample

This should be done by a trained specialist, such as an occupational hygienist or by a competent person, in accordance with *AS 2985 Workplace atmospheres – Methods for sampling and gravimetric determination of respirable dust* and *AS 3640 Workplace atmospheres – Methods for sampling and gravimetric determination of inspirable dust*.

The sample should be handled carefully after collection so the test results will be accurate. Ideally, the sample should be hand-delivered to the laboratory.

2. Laboratory analysis

If you employ an occupational hygienist, they will probably arrange for testing of the sample as part of their service. If you are conducting the testing yourself, you will need to select a competent laboratory. You should consider the following when choosing a laboratory.

- Is the laboratory accredited with the National Association of Testing Authorities?
- Is the laboratory quality assured?
- Does the laboratory report the results in a format that is understandable and provides all of the information required to perform the exposure calculations?
- Does the laboratory staff appear knowledgeable about your workplace operations, including other substances you use that could interfere with monitoring results?

3. Interpret the results

Once you have got your results back from the lab, you need to compare the actual exposure with the national exposure limit. This will help you to choose appropriate control measures for the dust hazard. If you have employed a consultant to conduct the monitoring, this will probably be part of their service.

If you are doing the calculations and interpretations yourself, you will need to consult the *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)]. It may also be a useful to follow an example to help you make your calculations. Don't forget to take into account whether the sample is collected as a total dust sample or as a respirable dust sample.

4. Take action

When monitoring identifies that the control measures are not adequate to prevent people being exposed to levels of dust above the exposure standard, abrasive blasting should cease.

Work should not recommence until:

- different work methods have been developed to ensure that people are not exposed to high levels of dust, or
- workers are provided with personal protective equipment that will limit their exposure to a level below the exposure standard.

Health surveillance

In certain situations, a relevant person must supply and pay for health surveillance required under the *Workplace Health and Safety Regulation 2008* Part 16 – Hazardous Substances and Part 17 - Lead. This health surveillance must be done by or under the direction of a designated doctor. Health surveillance, which includes biological monitoring, can assist in minimising the risk to health by:

- confirming that the absorbed dose of a substance is below the acceptable level, or
- providing biological results (such as an elevated blood lead level) requiring cessation of exposure.

The *Workplace Health and Safety Regulation 2008* identifies specific substances as requiring health surveillance. These include cadmium, crystalline silica and lead, commonly used in abrasive blasting. The primary technique for monitoring the working environment is usually to assess the concentrations of airborne dust and then to compare this with the safe exposure standard.

However, if dust may have been ingested or inhaled, biological monitoring techniques should also be used. For example, in a lead risk job, biological monitoring would measure the blood lead level of individual workers. Biological monitoring has the specific advantage that it can take account of issues that dictate an individual's response to particular hazardous substances. Some of these factors include size, fitness, personal hygiene, work practices, smoking and nutritional status.

Health surveillance should not be used as an alternative to proper implementation and maintenance of control measures designed to prevent exposure. For more information on health surveillance techniques required (e.g. x-ray, respiratory function tests), see Schedule 7 of the *Workplace Health and Safety Regulation 2008*.

Noise

Noise is unwanted sound that may damage a person's hearing. The amount of damage caused by noise depends on the total amount received over time. The degree of risk is affected by the intensity (loudness) and the frequency (pitch) of the noise, as well as the duration and pattern of exposure and the individual's susceptibility to hearing impairment.

Employers must prevent risks to their workers from exposure to excessive noise.

'Excessive noise' means a level of noise above:

- LAeq, 8h of 85 dB(A) - that is, an 8 hour equivalent continuous A-weighted sound pressure level of 85 dB(A), referenced to 20 micropascals, or
- Lc peak of 140 dB(C) - that is, a C-weighted peak sound pressure level of 140 dB (C) referenced to 20 micropascals.

Typical noise sources

In the abrasive blasting industry, the main noise source is from the discharge of compressed air at the blast nozzle. For the operator, the next major source is the feed air inside the protective helmet. Small blast cabinets as used by many workplaces in the metal industry are also significant sources of noise exposure for operators. Other sources of noise include air compressors, ventilation systems and air releases during pot blowdown.

An indication of the level of noise experienced in abrasive blasting processes can be obtained from the following noise readings taken at operator ear level.

- Air discharge from blast nozzle - 112 to 119 dB(A).
- Feed air inside helmet - 94 to 102 dB(A).
- Blast cabinets - 90 to 101 dB(A).
- Air compressors - 85 to 88 dB(A).

These are above the prescribed level and control measures are necessary!

Maximum noise levels up to 137 dB(A) and peak levels up to 145 dB(A) have been measured during blasting activities at the operator position when the abrasive runs out.

Operators of small abrasive blasting cabinets are particularly at risk. They may not perceive the noise to be damaging because of the relatively short periods of use. However, average noise levels at the operator's ears have been measured between 90 - 101 dB(A). This means that at 101 dB(A), for instance, an exposure of unprotected ears of only 12 minutes is allowed in any 8 hour shift so as not to exceed the exposure limit of 85 dB(A). In addition, other work activities must not contribute to further noise exposure.

Unprotected workers and others close to the blasting process may also be exposed to excessive noise.

Health effects

Noise exposure exceeding LAeq, 8h of 85 dB(A) presents a high risk to a person's health and safety at the workplace. A person working with or near noisy equipment or

processes may be affected by high direct or ambient noise and may develop noise-induced hearing loss in situations where no control measures have been put in place.

Regular exposure to high noise levels causes, in time, hearing loss through the destruction of the delicate hair cells in the inner ear's cochlea. This is often accompanied by tinnitus, or ringing in the ears. Damage to your ears can be compared to damage to your skin from sun exposure. In both cases, the damage is cumulative depending on the degree and length of exposure.

There is no cure for hearing loss.

Health effects of noise exposure include:

- temporary threshold shift – occurs immediately after exposure to high noise levels - the condition may last for minutes to hours
- noise induced hearing loss - occurs from long term exposure to high noise levels and is irreversible
- tinnitus - ringing in the ears which sometimes accompanies noise-induced hearing loss, and/or
- acoustic trauma - results from explosions or extremely loud impulses which may destroy hair cells and ear architecture.

Other effects from exposure to noise include increased heart rate and blood pressure, headache, irritability, nausea, insomnia, reduced concentration and depression. Vibration effects from exposure to excessive noise can also affect a person's sight, for example, loss of clarity, colour perception and night vision.

In addition to the risk of temporary or permanent hearing loss, high noise levels may cause difficulties in verbal communication and in hearing warning signals or emergency commands.

Control measures

Substituting an alternative surface preparation method
You should determine whether methods of cleaning other than abrasive blasting may be employed.

Isolation
Methods which can be used to isolate workers and other persons from noise include:

Exclusion zones
Areas where noise levels are in excess of the exposure standard should be identified and entry restricted to persons with adequate hearing protection. Exclusion zones should be identified by appropriate signs in accordance with *AS 1319 Safety signs for the occupational environment* which warn workers and others that high noise levels exist and that hearing protection is to be worn.

Relocating or enclosing noisy equipment
Blast cabinets, air compressors, and grit pots can be located in acoustic enclosures (sound proof) or separate rooms away from the work area so as not to expose other workers.

In the open air, mobile enclosures, lined internally with sound absorbent material could be used at locations where noisy work has to be carried out and other people may be affected. Such enclosures could reduce operator exposure by about 5 to 20 dB(A) depending on construction. They could also reduce the exposures of people nearby.

Blast chambers
Shifting the site of the blasting away from other workers

Engineering controls

Engineering controls which can be implemented in relation to abrasive blasting include:

- improved mufflers on blast pots
- silencers on intake and exhaust systems
- baffles and muffling materials in air supply hoses for blast helmets
- sound attenuating material on walls and ceilings
- sound transmission barriers around compressors.

Administrative controls

Some administrative control measures which can be used to reduce excessive noise include:

- undertaking abrasive blasting out of normal working hours
- stopping other work and clearing people from a site while blasting is taking place
- 'buy quiet' policies, whereby quieter machines and equipment are purchased, where possible, when replacement is necessary
- adequate training
- reducing the amount of pressure needed to abrade the substrate
- limiting the amount of air required in air-fed helmets to a minimum
- maintenance of plant and equipment, including personal protective equipment
- job rotation, and
- regular noise exposure surveys.

Personal protective equipment

Personal hearing protectors
Where noise control cannot be achieved through any of the measures described above, you should provide suitable personal hearing protectors, as well as proper instruction and training in their use. Examples of personal hearing protection devices include ear plugs, ear canal caps, ear muffs, and hearing protective helmets.

Personal hearing protectors should have passed the physical tests specified in *AS 1270 Acoustics – Hearing protectors*.

When selecting suitable hearing protectors, you should consider the following:

- type of working environment
- comfort, weight and clamping force
- combination with other items of personal protective equipment

- safety of the wearer
- opportunity for personal choice, and
- hygiene aspects.

Review of control measures

Monitoring
Monitoring should be undertaken to ensure workers are not exposed to levels in excess of the exposure standard of 85 dB(A).

All monitoring should be conducted by a competent person, i.e. a person who, through training, education and experience in acoustics and the principles of noise control, has the necessary expertise to conduct sound level measurements, and to interpret them.

Monitoring should be conducted in accordance with *AS/NZS 1269 Occupational noise management*, at random intervals during the abrasive blasting process.

Where it is identified that unprotected persons are exposed to noise levels in excess of the exposure standard, abrasive blasting should cease. Work should not be recommenced until different work methods or equipment modifications have been developed to reduce workers' exposure to below 85 dB(A), or where this is not practical workers have been provided with personal protective equipment that will reduce their exposure to below 85 dB(A).

Particulate matter

Particulate matter includes small particles of the object being blasted, or of the abrasive material. Particulate matter can also include water. Workers carrying out abrasive blasting can be struck by particulate matter.

Health effects
Serious injuries or death can result from being struck by particulate matter discharged under high pressure. Common injuries include:
- eye damage
- severe lacerations burns, and
- skin penetration.

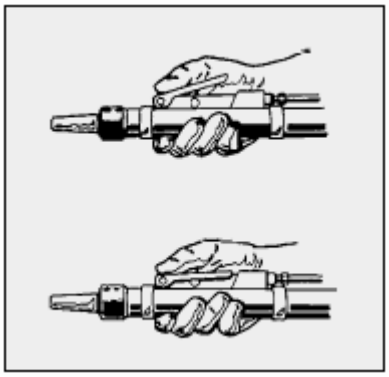
Control measures

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 using 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

Self-actuating cut-off devices
Abrasive blasting equipment must be fitted with a fast acting self-actuating cut-off device under the direct control of the nozzle operator.



The risk of sustaining a serious injury from particulate matter is increased when:
- blasting in a confined space
- working in an elevated position, and
- the operator is out of the line of sight of a pot tender or there is no dedicated pot tender who can provide assistance if required.

Using a blast machine without a fast acting self-actuating cut-off device under the direct control of the operator is a dangerous practice that may result in serious injury or death.

The device most commonly used is called a remote control or ’dead man control’ which is usually attached to the nozzle. When the nozzle is dropped, the air supply shuts off and prevents the whipping hose injuring the worker and the abrasive material firing at the operator or other people nearby. For more information on ’dead man controls’ refer to the following section on abrasive blasting plant and equipment.

Hose whip checks and hose coupling safety locks
Abrasive blasting equipment must have hose whip checks or hose coupling safety locks.

More information on blast hoses, hose whips and couplings can be found in the following section on abrasive blasting plant and equipment.

Administrative controls

- When blasting, the nozzle should only be pointed at the work. A blast nozzle should never be pointed at any person.
- Blast hoses should be uncoiled when in use.
- Blasting personnel should be adequately trained in the use and maintenance of 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, and
- protective clothing (overalls, long trousers, blast suits, aprons).

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. 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 full 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.

Air compressors and blast pots

- All pressure vessels should be designed to comply with *AS/NZS 1200 Pressure equipment*.
- Planned inspection and routine maintenance should be carried out by a competent person in accordance with *AS/NZS 3788 Pressure equipment – In-service inspection,* and the manufacturer's instructions.
- All valves should be of a rating equivalent to that of the pressure vessel and be correctly attached.
- A safety release valve should be fitted on the compressor or air supply system and regularly checked.
- Blow-down procedures (if applicable), should be developed and implemented. Never exceed the rated working pressure as this may lead to explosion.
- A muffler should be attached to blast pots to reduce the noise from escaping air when the machine is depressurised.
- Portable blast pots should have wheels and be ergonomically designed.

Nozzle

- Where dry blasting is being conducted, an efficient means for the discharge of static electrical 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.
- The nozzle lining and threads should be checked for wear and damage. Use nozzle washers, and replace them when they show signs of wear.

Dead man controls (also known as remote controls or self-actuating cut-off devices)

- 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.
- Electric controls are recommended for distances over 40 metres as they respond almost instantly and response times do not increase with distance.
- Deadman controls are subjected to rough treatment because they are located at the nozzle. This results in damage and rapid wear. 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 modify, remove or substitute parts. Follow instruction manual recommendations for inspection, maintenance and cleaning for each component.
- Never tape down or prevent free movement of the control handle. This defeats the safety purpose of the remote control system and may cause serious injury if an uncontrolled nozzle is dropped.
- Inspect and clean control hose line fittings before connecting them as dust and dirt will clog air passageways throughout the system and may damage control valve cylinder walls.

Blast hoses, hose whips and couplings

- Hoses or couplings should be purpose designed.
- Never exceed a blast hose's rated working pressure.
- Hoses should be constructed with anti-static rubber linings or fitted with an earth wire or similar mechanism to prevent electric shock.
- 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.
- Use safety cables to support the weight of elevated hoses.
- Do not tape pin holes in the blast hose. The hole will enlarge quickly and will cause a blow-out.
- Blast hoses should be coiled and stored away from water, oil and chemicals to prevent rotting.
- Check coupling fit.
- Use the screws furnished by the coupling manufacturer.
- Ensure that the hose end fits uniformly flush with coupling shoulder.
- Be sure nozzle holders and couplings fit snugly on the blast hose. Reject those that are loose.
- Replace hoses that have a damaged outer cover.

Water blasting equipment

- Nozzles must be fitted with a fast acting self-actuating cut-off device (deadman control).

- High pressure hoses should be firmly secured at a distance of no more than 3 meters from the operator.
- All bypass valves should be equipped with pressure safety relief valves.
- Consider fitting a funnel near the end of the nozzle to minimise the risk of the water stream coming into contact with the operator.
- Wet blasting equipment must have a water flow rate capable of preventing dust from forming from the blasting operation.
- Inhibitors containing chromate, nitrate and nitrite must not be used.

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 national exposure limits when the cabinet is opened.
- In conjunction with the air change rate, a suitable clearing 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 further most 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 1 metre above the floor of the blasting chamber or enclosure.
- They must have an electrical supply which complies with the Australian and New Zealand Standard series *AS/NZS 2381 Electrical equipment for explosive gas atmospheres* and *AS/NZS 3000 Electrical installations (known as the Australian /New Zealand 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 5 minutes after blasting has finished and during blowdown 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 possible the object should be fully enclosed.
- 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. Selection should also consider fire retardancy, burst strength, and UV resistance.
- Shade cloth will not prevent the escape of fine dust, and should not be used for temporary enclosures if the work generates silica, lead, or other toxic dusts.
- Temporary enclosures should be fitted with a dust extraction/ collection system.
- Where monitoring indicates that persons in surrounding areas may be exposed to dust levels in excess of the national exposure standards, they should be excluded from the area, where possible, by warning signs and barricading, and/ or provided with personal protective equipment (PPE).

Respirators (including blast helmets)

- People inside blasting chambers or enclosures must wear a blast helmet type airline respirator complying with *AS/NZS 1716 Respiratory protective devices* which is fitted with an inner bib and a shoulder cape, jacket or protective suit.
- Respirators complying with *AS/NZS 1716 Respiratory protective devices* must also be worn when cleaning, maintaining or repairing a blasting room or enclosure or when working near areas used for abrasive blasting.
- When using a properly designed and maintained cabinet, there is no need to wear a respiratory device. Respiratory equipment should be maintained and used in accordance with the requirements of *AS/NZS 1715 Selection, use and maintenance of respiratory protective devices* and the manufacturer's instructions.

- All users of respirators must be adequately trained in their safe use and maintenance.
- Respiratory equipment must be fitted for each person individually and if it is to be used by another operator, it must be disinfected and refitted before use.
- The tightness of all connections and the condition of the face piece, headbands and valves should be checked before each use.
- Never drop a helmet or leave it in areas where it might be exposed to dust and dirt.
- After removing the helmet, vacuum dust from the helmet and cape. Place the cleaned helmet in a plastic bag and store it in a dust-free area.
- The helmet cape requires periodic cleaning, frequent inspection and immediate replacement if damaged. NEVER use tape to repair holes or worn areas. Replace the inner collar when the elastic becomes stretched out of shape.
- At least once a week, wash the inside of the helmet with warm water and mild detergent. Detach the cape and inner collar from the helmet and wash in warm water and mild detergent.
- Replace window frames and window seals immediately if there is any leakage. The outer lens of the helmet should be replaced when it starts to frost over.
- In most cases, additional hearing protection will be required.

Supplied air for respiratory equipment

- Supplied air for respiratory equipment must be supplied at a rate of at least 170 litres / min.
- It must contain at least 19.5% but not more than 22% oxygen by volume.
- It must be passed through a purifying device to ensure it does not have an objectionable or nauseous odour.
- It must not contain more than 900 ppm of carbon dioxide, 11 ppm of carbon monoxide, or 1 mg per cubic metre of oil (when measured at 15 degrees Celsius and 100 kPa).
- It must be passed through a conditioner to ensure it is supplied at a temperature of at least 15 degrees but not more that 25 degrees and within a humidity range of at least 20% but not more than 85% .
- It must be passed through a condensate trap fitted with a drain cock to remove condensed liquid.
- It must be passed though a circuit or controlled leak-off to eliminate stale air.
- Air supply equipment must be kept in working order and in a place where it is protected from contaminants.
- The compressed air equipment must also have a thermostatically controlled interlock to cut off the air supply if it overheats.
- Breathing air hose connections must have a system to prevent accidental disconnection and fittings that cannot be connected to other compressed air equipment.
- Breathing hoses should have non-toxic linings.
- Air lines and fittings should be inspected each day for worn areas and leaks. Air lines should be routed as straight as possible.
- Do not place breathing air lines where vehicles can run over them.

Eye and skin protection

- Skin and foot protection must be worn by people engaged in abrasive blasting activities.
- Protective eye equipment should meet *AS/NZS 1336 Recommended practices for occupational eye protection* and *AS/NZS 1337 Eye protectors for industrial applications*.
- Protective gloves should meet the Australian and New Zealand standard series *AS/NZS 2161 Occupational protective gloves*.
- Protective footwear should meet the Australian and New Zealand standard series *AS/NZS 2210 Occupational protective footwear*.
- Protective clothing such as overalls, long trousers or blast suits should also be worn.

Part B: Hazards of protective coating processes

The major hazards in protective coating processes are associated with:
- hazardous substances in protective coatings and solvents
- misuse and poor maintenance of spray painting plant and equipment, and
- explosion of flammable substances.

Other hazards are similar to those encountered in abrasive blasting, and may include:
- manual handling slips, trips and falls
- working in confined spaces
- working on elevated work platforms, and
- heat.

These need to be assessed at an individual workplace level.

Health and safety effects

Many protective coatings and solvents used in this industry contain hazardous substances. A particular concern is the use of organic solvents as a degreasing or cleaning agent or as a paint thinner. Solvents and hazardous substances can enter the body through inhalation of vapour, through the skin, or by being swallowed. They can irritate the skin, eyes, mucous membranes and cause both short and long term health effects.

Each application method presents different levels of risk. For example, when applying coatings by brush or roller, the risks are usually limited to the inhalation of toxic vapours given off by the coating or from splashes of paint which may land on the skin or in the eyes.

When applying coatings by spray painting methods, a higher degree of risk exists for applicators as these methods emit more paint fumes, mists and aerosols into the working environment.

The priority health and safety issues for protective coating applicators include:
- occupational lung disease (including occupational asthma)
- occupational cancer

- painters' syndrome (resulting from long term exposure to organic solvents)
- reproductive hazards
- occupational skin diseases (including allergic contact dermatitis)
- consequences of paint injection into the skin, and
- consequences of fire and explosion.

Control measures

Elimination / substitution
There are three ways of looking at substitution for controlling the risks from protective coatings and solvents:

1. Substitute a safer alternative, for example, use water based paints instead of solvent based paints.
2. Substitute another method of application, for example, brush or roller application for spray painting.
3. Substitute the spray painting process, e.g., use airless instead of conventional air spraying to reduce the amount of overspray and toxic substances in the air.

Isolation
A practical way of isolating unprotected workers and other people from exposure to toxic substances is by exclusion or hazard zones: an area created around a work activity where access is denied to people not wearing the required protective equipment. The size of the exclusion zone should be determined as part of the risk assessment process.

Engineering controls

An effective control measure to minimise exposure to toxic fumes from protective coating and solvents is to remove contaminated air directly from the source. This can be accomplished by carrying out spray painting in a spray booth fitted with an extraction ventilation system.

Where this is not possible because of the size of the object, or where the work consists of minor spotting or touching up operations, or where the work is not carried out in the open air, local exhaust systems which draw the fumes away from the source should be used.

These exhaust systems should be carefully placed so that the drift of contaminated air being drawn into the extractor does not go through the breathing zone of the applicator or other workers. Fresh air should also be directed into the work area to replace the contaminated air being removed.

NOTE: Before spray painting in open air, consult your local government authority for environmental protection requirements.

Administrative controls

Administrative controls largely involve the development of safe working practices and procedures that should be used in combination with other control measures such as ventilation. The procedure or practice implemented at a workplace should reflect

the specific needs of the workplace and meet the engineering specifications of the application method.

Some issues to be considered when developing procedures include:

- not pointing the spray gun at any part of the human body
- not eating, drinking or smoking in a spray painting zone
- storage and disposal of waste and solvent soaked cleaning rags
- maintenance checks for spray painting equipment
- minimising the risk of inhaling vapours through the use of smaller containers of paints and solvents
- recapping immediately after use and prompt clean up of spills
- mixing of protective coatings only in authorised areas, for example, mixing room with exhaust ventilation
- following paint manufacturers' recommendations to reduce overspray
- selecting a spray tip to ensure the atomisation is no finer than necessary, and
- training workers in safe work practices, including the use and maintenance of personal protective equipment.

Protective coatings and solvents

Before using a protective coating or solvent, a risk assessment must be carried out to determine:

- who will be exposed
- the health effects of exposure
- whether monitoring or health surveillance is required, and
- whether control measures are required to prevent or minimise exposure.

Each protective coating and solvent should have its own material safety data sheet (MSDS) which should be referred to as part of the risk assessment. The MSDS should detail hazards of the coating or solvent and minimum requirements for its safe use. This information will assist the identification of required control measures.

Where the protective coating contains a hazardous substance you should refer to Part 16 – Hazardous Substances of the *Workplace Health and Safety Regulation 2008* for specific requirements. In addition, you should also refer to the *Hazardous Substances Code of Practice.*

Where the protective coating contains a hazardous substance and you apply it in a spray painting process, you should refer to Division 5 - Spray painting with hazardous substances of Part 16 - Hazardous substances for specific requirements.

NOTE: The following information is provided as general practical advice.

Some of the more commonly used control measures include:

Personal protective equipment

In most other industries, personal protective equipment (PPE) is used as a last resort. However, in the protective coating industry, as in abrasive blasting, it should be used

at all times in combination with other controls outlined above. PPE must protect workers against all routes of exposure (skin, eye and inhalation).

Skin protection
All exposed skin should be covered. Many products are available to achieve this including overalls, long sleeve shirts and trousers. In addition, barrier cream can be used for short term protection.

Chemically resistant gloves, safety boots and aprons are made from a range of synthetic or natural materials with varying permeability to solvents and other hazardous substances in paints. The MSDS will provide information on the appropriate type of PPE required.

Respiratory protection
Where monitoring indicates that toxic vapours in the air are at an unacceptable level and other methods of control are unsuitable, a respirator will be required. The MSDS will provide information on the appropriate type.

As workers may experience restricted movement or personal discomfort, PPE programs may be difficult to administer and maintain. Helpful hints to overcome these problems include:

- instructing workers on the need and correct use of PPE
- issuing PPE prior to starting work
- ensuring that PPE fits properly and comfortably
- maintenance and replacement of PPE as required, and
- avoiding sharing PPE.

Spray painting plant and equipment

In protective coating applications, ‘plant’ includes spray painting guns, spray booths, pumps, compressors, hoses and ventilation systems.

Major hazards from spray painting plant include:

- increased exposure to toxic fumes because of poorly maintained ventilation and extraction systems, and
- the risk of electric shock.

The *Plant Code of Practice* contains general requirements for the installation, maintenance and use of all types of workplace plant. You should refer to it when assessing risks.

Of particular concern is the risk of paint injection into the skin or any part of the body when using high pressure airless spraying equipment. Paint can be injected into the bloodstream, resulting in a lack of blood supply to the area, and ultimately to amputation of fingers or hands.

To avoid the risk of injury from paint injection the following points should be noted.

- The safety catch should always be switched on to avoid the danger of the spray gun trigger being accidentally pulled during stoppages in work or when the spray tip is being changed.

- Operators should never point the spray gun at themselves or any other person.
- Fingers and hands should be kept well away from the spray jet.

NOTE: If the skin has been penetrated, medical advice should be sought immediately.

Fire and explosion

Many protective coatings and solvents are highly volatile and flammable substances. When atomised into the air they spread and rapidly fill the airspace, creating the risk of fire and explosion if they come into contact with any sources of ignition such as open flames, static electricity or sparks. To avoid the risk of fire and explosion you should note the following points.

- Equipment should always be properly earthed. The speed of material flow at high pressures in spray painting processes may produce an electrostatic charge in the equipment. When discharged, this can cause sparks or ignition.
- When cleaning equipment, never spray paint back into a container. The rebound of the paint jet can trap air in the container and set up a potentially explosive gas/ air mixture.
- Paint and solvent soaked rags can spontaneously burst into flames.
- Combustion motors should not be used in a confined space spray painting area.
- All flammable substances should be correctly stored.

Part C: General hazards common to both processes

Because abrasive blasting and protective coating processes can be carried out in many unique working environments such as on-site work, it is not possible to identify all situations in which workers may be exposed to risks. However, there are broad risk groups that are common to these types of work.
These include:

- manual tasks
- working in confined spaces
- working at heights
- slips, trips and falls
- vibration, and
- heat.

Because of the great number of ways in which these particular risks may arise, it is only possible to give general advice on control options for each risk group. You should conduct individual risk assessments for your specific circumstances. See section '**Risk management process**' for how to conduct a risk assessment.

Manual tasks

Many abrasive blasting and protective coating processes involve manual tasks. Manual tasks are those workplace activities requiring the use of force exerted by a person to lift, lower, push, pull, carry or otherwise move or restrain any object. Manual tasks can range from transfer of heavy loads to tasks involving repetitive or forceful movement and maintenance of constrained or awkward postures.

Some examples of manual tasks often encountered in abrasive blasting and protective coating processes are:

- lifting bags of abrasive or tins of protective coating
- lifting, pushing or pulling blast pots
- lifting or moving work pieces to be blasted or coated
- restraining a blast hose, and
- repetitive movements associated with abrasive blasting or protective coating activities.

The risk associated with manual tasks can be compounded by factors including workplace environment and layout, working posture and position, types of loads and equipment used, length of time spent on manual handling tasks, the frequency of manual handling tasks, distance loads are to be moved and personal characteristics of the worker.

Health effects

Manual task injuries in the abrasive blasting and protective coating industry are not confined to the back but also include injury to the neck and upper limbs (shoulders, forearms, wrists and hands). Injuries may occur as a result of a single event, however they are more often the result of cumulative strain due to awkward postures, movements, weights and forces on the body.

Manual task injuries include:

- strains
- sprains
- fractures
- dislocations
- bruises
- overuse injuries.

Control measures

Elimination / substitution

In many instances it will not be possible to eliminate the need for manual tasks. However where practical, elimination may be achieved by only purchasing plant and equipment which has been designed to eliminate the need for manual tasks. In some cases it may be possible to use bulk storage hoppers from which individual blasting pots can be refilled as required.

Where it is not possible to totally eliminate manual tasks, substituting smaller bags of abrasives or purchasing equipment such as blast pots with wheels and handles will reduce the risks.

Engineering controls

Workplaces should be designed to reduce the amount of force necessary to perform the task. For example a workplace layout should be organised to provide an uninterrupted path and reduce the distance that materials and equipment need to be moved. This can be achieved by storing bags of abrasives at a level between mid-thigh and shoulder height and near the blast pot. Risks can be further reduced by using trolleys, cranes, hoists or forklifts to move work pieces or supplies of abrasives.

Administrative controls

Although the weight of the load is not the sole indicator of the risk of a manual task injury and there is no legislation stating maximum weight, administrative controls such as the introduction of in-house rules in regard to maximum weights to be lifted, can reduce the risk of injury. Guidance may be sought from the *Manual Tasks Code of Practice* and the '*National Code of Practice for Manual Handling* [NOHSC:2005(1990)]'.

The following flag point weights should be considered when introducing these rules.

- Lifting loads above the range of 16-20 kg may increase the risk of back injury. Loads should be kept below or within this range.
- Mechanical assistance or team lifting arrangements should be implemented for loads 16-55 kg.
- Loads over 55 kg should not be lifted, lowered or carried by a worker without mechanical assistance unless team lifting arrangements are used.
- Loads above 4.5 kg ideally should not be lifted during seated work.
- Workers under 18 years of age should generally avoid lifting, lowering or carrying objects more than 16 kg.

Here are some helpful hints when developing in-house rules regarding manual handling tasks.

Plan the lift and determine the best technique for the situation.

- Adopt a comfortable posture and try to keep the back straight.
- Lift gradually, smoothly and rhythmically (avoid jerking).
- Get a secure grip on the object.
- Avoid unnecessary bending by placing objects at a level between mid-thigh and shoulder height.
- Avoid twisting your back.
- Avoid reaching out.
- Handle heavy or awkward objects as close as possible to the body.
- Where possible, break up tasks to avoid repetitive bending - vary heavy handling tasks with lighter work.
- Alternate repetitive and non-repetitive work (e.g. job rotation).
- Team lifting should be adopted when a load is either too heavy or awkward for a single person to lift or mechanical devices are not available.

You should provide education and training on the correct methods of carrying out manual tasks and lifting techniques at regular intervals. This should also include training in the correct use of mechanical devices.

Working in confined spaces

A confined space is an enclosed or partially enclosed space which:
(a) is at atmospheric pressure when anyone is in the space
(b) is not intended or designed primarily as a workplace
(c) could have restricted entry to, or exit from, the place
(d) is, or is likely to be, entered by a person to work, and
(e) at any time, contains, or is likely to contain, any of the following:
    (i) an atmosphere that has potentially harmful levels of a contaminant
    (ii) an atmosphere that does not have a safe oxygen level, and
    (iii) anything that could cause engulfment.

A worker whose upper body or head is within a confined space is considered to have entered the confined space. Employers must identify any hazards associated with working in a confined space. The primary hazards commonly found in confined spaces are:

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

Employers must also ensure a risk assessment is done by a competent person before workers enter confined spaces. Any risks identified must be eliminated or minimised.

Health effects
A wide range of injuries can be sustained from working in a confined space including:

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

Control measures

Elimination / substitution
You should assess the need to undertake abrasive blasting in a confined space.

Isolation
The confined space should be isolated to avoid the introduction of harmful substances or activation of moving parts e.g. isolate the confined space from power sources, remove valves, lock or tag all moveable components.

Engineering controls

Mechanical ventilation systems must be used to remove hazardous contaminants produced by the work being done in the confined space.

Non-sparking tools must be used where there is a flammable atmosphere.

Administrative controls

You should develop and document a method for confined space entry.

Before entry
The following issues should be addressed.

- Worker selection (aptitude and fitness for task and confined space entry).
- Worker training in:
  - emergency entry and exit procedures
  - use of PPE
  - first aid including cardiopulmonary resuscitation (CPR)
  - lockout procedures
  - rescue drills
  - fire protection
  - communications.
- Define responsibilities of responsible persons to:
  - co-ordinate planning and supervision of work
  - implement emergency rescue plan
  - signpost work area
  - isolate confined space
  - evaluate confined space environment
  - monitor confined space during work
  - ensure operative rescue equipment and trained staff are available
  - authorise entry by permit
  - suspend work / evacuate space if conditions warrant.

The potential hazards in the confined space should be determined before entering.

At the time of entry
The following factors should be considered by those developing the work procedure.

- Isolation of the confined space:
  - blank flange piping
  - disconnect lines
  - isolate and lock-out/ tag-out mechanical and electrical energy sources.
- Precautions at entrances to confined space:
  - signs
  - barricades
  - rescue equipment.
- Initial testing and recording of confined space atmosphere:
  - oxygen deficiency or excess
  - chemical agents
  - physical agents.

- Comparison of initial test results with existing standards to determine ventilation and / or personal protective requirements.
- Adequate illumination and visibility to allow safe work to continue.
- Ventilate and provide personal protective equipment.
- Ensure that the breathing air line to the respirator is protected.
- Provide rescue capability (including a person outside suitably equipped) and escape equipment.
- Issue entry permit.

While work is being undertaken in the confined space
The following actions should be taken:
- continuous or periodic monitoring of confined space atmosphere, and
- implementation of safe work practices.

After work has been completed
- A permit should be reissued after prolonged absence from area or if conditions change.
- Confirmation should be given that all persons and equipment are accounted for.
- The operation should be reviewed (including unsatisfactory aspects).
- The completed job should be accepted by a competent person.

Training and education
All workers associated with work in a confined space must be given training which includes:
- the hazards of confined spaces assessment procedures
- control measures
- emergency procedures, and
- the selection, use, fit and maintenance of personal protective equipment.

Personal protective equipment

Where it is not practical to provide a safe oxygen level, or the atmospheric contaminants cannot be reduced to safe levels, only people equipped with suitable personal protective equipment including air-supplied respiratory protective equipment should enter the confined space.

In all instances of abrasive blasting or application of protective coatings in a confined space, air-supplied respiratory devices and safety harnesses and lines should be used. Where air-supplied respirators are required, you should consider protection of the breathing line to the respirator.

Personal protective equipment and rescue equipment should be selected and fitted to suit the individual.

Review of control measures

Employers should ensure that atmospheric testing methods are appropriate for the hazards identified.

Working at heights

Falling is a major risk whenever a worker is required to work above or below ground level and can result in a multitude of injuries including head injuries, spinal injuries, internal injuries, fractures and dislocations.

Workers may be exposed to the risk of falling when carrying out blasting or coating activities:

- on external faces, edges and the perimeter of buildings or structures
- from penetrations in the work environment from holes cut or formed in the working surface
- on fragile roofs and floors
- when accessing the worksite
- in excavations, and
- during erection and dismantling of plant and framework.

Because of the significant risk of death and serious injury from working at heights Queensland legislation requires that fall protection be provided for persons working at 2m for construction work (other than when working on housing construction where the limit is 3 metres). Below these threshold heights, Queensland legislation requires that a risk assessment must be applied.

Control measures

The aim of the control measures is to prevent the person from falling.

Elimination / substitution
You should examine the need to work at heights. The article to be blasted or coated may be able to be moved to ground level or a less hazardous place (preferably to a blast chamber or a spray painting booth).

Engineering controls

Blasting nozzles should be fitted with an earthing device to prevent the build up of static electricity from the abrasive moving at high velocity through the blasting hose. Although the mild shocks possible are not sufficient to cause electrocution, they may cause the operator to lose balance and fall when working at heights.

Administrative controls

If working at heights can not be avoided, physical barriers should be put in place to stop the person from falling. These include:

- edge protection systems e.g. guard railing with mid rails, containment sheeting, hoarding
- fall protection covers over holes and openings
- working platforms e.g. elevating work platforms such as scissor lifts, boom type elevated, and
- platforms or mast climbers.

Scissor lifts and cherry pickers should be fitted with operator's controls and hand and toe rails.

The choice of staging should take account of the operators' needs for freedom of movement to complete the task safely. Extra precautions should be taken when blasting from a scaffold because an air-fed helmet does not allow a full field of vision, so planks should be wide and tightly secured for maximum footing.

Where work is to be undertaken in an elevated position, the level of lighting should not be less than 200 lux for the working area and 50 lux for stairs or other areas giving access to the work area (as per the Australian Standard).

This should ensure operators are able to see:
- the physical limits of the work platform
- any other people in the work area, and
- all control devices.

Some general rules which should always be applied when blasting at heights are:
- no one should work below blast operators - a nozzle or hose dropped can kill or cause severe injury
- stop frequently to sweep or clean abrasive media from all horizontal surfaces on the staging - footing can be treacherous on loose abrasive, and
- use ropes or other strong attachment methods to secure the blast hose to the staging - this relieves the operator from the weight of the hose and prevents a dropped hose from falling.

Personal protective equipment

Personal fall protection equipment
Personal fall protection systems are systems which secure a person to a building or structure. They should only be used where it is not possible to use physical barrier systems such as working platforms, edge protection or fall protection covers. However, personal fall protection may be used in addition to physical barrier systems of fall protection.

Personal fall protection equipment includes:
- travel restriction devices which prevent a person falling e.g. industrial rope access systems and fall-prevention systems
- fall arrest systems which arrest a person once he or she has fallen e.g. fall-arrest full harness with lanyard assembly, and

- persons should be properly trained and supervised in the use of this equipment. In addition, it is important when using a fall-arrest system to ensure there are no obstructions in the potential fall path.

Footwear
Footwear should comply with the requirements of Australian Standards and should be non-slip.

Other control measures after a person has fallen
The use of control measures to catch a person after a fall should only be used where it is not possible to provide any other more reliable means, such as the erection of physical barriers and personal protection systems.

Control measures to catch a person include:

Catch platforms
A catch platform is a temporary platform located below a work area. The platform should be of robust construction and designed to sustain the impact of a person falling onto it. A catch platform should be placed as close as possible to the underside of the work area to minimise the distance a person can fall from the work platform.

Safety nets
A safety net is an industrial net which is attached to or supported by a scaffold or attached directly to the framework of a building, bridge or tower to catch a person who has fallen.

Slips, trips and falls

Health effects
Injuries to arms, legs and the head can result from striking these body parts when tripping, slipping or falling.

Control measures

Isolation

Exclusion zones
The number of people in the work area should be limited to those actually undertaking abrasive blasting or applying a protective coating.

Signs and barricades which limit entry to the work area will reduce the potential for persons to suffer injury through:

- slipping on wet surfaces
- tripping on hoses, and
- being struck by objects loosened by abrasive blasting.

Administrative controls

The risk of injury through slips, trips or falls may be reduced by maintaining a clean and tidy workplace. Attention should be paid to:

- the amount of water or other liquids on the ground in the work area
- regular cleaning of waste material (particularly during wet-blasting)
- keeping hoses straight
- keeping access-ways clear of obstruction
- reducing the number of sharp edges that may catch loose clothing, and
- putting tools and equipment away when finished.

The risk of injury may be further reduced by ensuring that there is adequate visibility in the workplace.

Personal protective equipment

The type of equipment necessary will be determined as a result of the risk assessment, and may include:

- non-slip footwear
- protective headwear, and
- eye protectors.

Vibration

Abrasive blasters are subject to hand-arm vibration from the force of the abrasive moving through the blast hose.

Health effects

Prolonged use of abrasive blasting equipment may lead to a condition known as white finger (dead finger or Feynaud's phenomenon). It results from persistent microscopic damage to nerves and blood capillaries.

Symptoms include:

- blanching and numbness in the fingers
- decreased sensitivity to touch, temperature and pain, and
- loss of muscular control.

Chronic exposure may result in gangrenous and necrotic changes in the finger. There is no effective treatment to reverse the effects of white finger.

Control measures

Elimination / substitution
The use of vibration-reduced equipment such as vibration isolating handles incorporated into blasting nozzles may decrease the incidence of white finger.

Administrative controls

The length of time an operator is required to operate a blast nozzle should be kept to a minimum. This may be achieved through job rotation or more frequent breaks.

Frequent maintenance of equipment may also reduce the levels of vibration.

Personal protective equipment

Protective gloves may be of limited assistance in dampening vibration.

Heat

Heat is a problem due to the type of personal protective equipment (blast helmets, protective suits or leather coveralls) required to be worn, sometimes for long periods.

Health effects
The major risk associated with heat is heat stress.

Where the body is unable to lose heat fast enough through evaporative cooling to maintain a steady core temperature, it begins to experience physiological heat strain with different illnesses depending on the degree of heat stress.

Potential health effects for persons under increasing levels of heat stress include:
- discomfort irritability
- dehydration
- reduced concentration
- heat rash
- reduced tolerance to chemicals and noise
- exposure heat cramps, and
- heat exhaustion heat stroke.

Heat cramps, heat exhaustion and heat stroke are the most serious forms of heat illness. The effects of heat stress are likely to increase in the summer months.

Some workers may be more susceptible to heat stress than others.

These include those who are:
- unacclimatised to heat levels associated with the work
- physically unfit
- overweight
- elderly
- wearing inappropriate clothing
- suffering from heart, circulatory or skin disorders
- dehydrated, and

- using medications that impair temperature regulation or perspiration.

Control measures

Administrative controls

The use of personal protective equipment required for abrasive blasting often leads to a build-up of heat.

The effects of this may be counteracted by:
- limiting the amount of time any one operator is required to operate continuously e.g. through job rotation
- taking frequent breaks and by drinking cool water regularly, and
- shading an outdoor work area from the sun or scheduling work hours other than in the middle of the day.

Personal protective equipment

Heat build-up may be reduced by ensuring the comfortable fit of the personal protective equipment. Heat stress may also be reduced by the fitting of air conditioning units to the air supply of blast helmets.

Heat reflective clothing may also be of assistance where working outdoors in the sun.

Part D: General information

Risk management process

Risk management plays an important role in the management of workplace health and safety. It is a logical and systematic approach which can result in a reduction in the incidence of injury and illness.

The basic steps in the risk management process are:
- identify the hazards
- assess the risks
- decide on suitable control measures, and
- apply and monitor the controls.

Identify the hazards
You need to identify the hazards in your workplace. A hazard is something which could cause injury or disease.

You can identify these hazards by:
- talking with workers
- inspecting the workplace
- breaking down work tasks into individual elements to recognise risks easily
- reviewing incident, accident and injury data

- reviewing any statistics, hazard alerts or other reports from relevant associations
- reviewing material safety data sheets (MSDS), product labels and manufacturers' specifications, and
- seeking advice.

Assess the risks

Where a hazard is identified, an assessment of the risks associated with the hazard must be made. Risk assessment seeks to prioritise identified hazards so that effort can be directed to eliminate or control risks that have a high potential to cause harm.

Identified hazards are assessed to determine their real potential to cause injury or disease. The likelihood of the hazard causing an injury (probability) and the severity of the injury (consequence) are considered when prioritising the hazards.

A simple method of assessing risks is outlined below.

Risk priority chart			
Probability How likely could it happen?	Consequence How severely could it hurt someone?		
	Catastrophic Kills, disables	**Major** Significant injury	**Minor** First aid only
	Permanent injury	**Not permanent**	**No lost time**
Very likely Could happen frequently	**1**	**2**	**2**
Likely Could happen occasionally	**2**	**3**	**4**
Unlikely Could happen rarely	**3**	**4**	**5**
Very unlikely Could happen, probably never will	**4**	**5**	**6**

From this chart you can give a specific hazard a risk priority. If you score a:

- 1 or 2, do something **now**
- 3 or 4, do something soon
- 5 or 6, do something to address the risk.

For example, operators undertaking dry blasting activities are constantly exposed to respirable dust. If the dust contained free crystalline silica, the consequences are catastrophic.

With a probability very likely, this gets a rating of 1 which means it needs to be fixed immediately - before work continues.

A person may be walking through an area and slip on loose abrasive, suffering an abrasion to the hand. The probability is likely and the consequence minor, so this gets a rating of 4 which means it needs to be controlled as soon as possible but after more immediate risks have been attended to.

A blank risk assessment form is included at the end of this section to help you to assess the risks in your workplace. You should conduct a separate risk assessment for each hazard identified.

Decide on suitable control measures

Appropriate control measures must be put in place to eliminate the risk or where it is not practical to do so, the identified risk must be minimised. The most common method used to decide which of the available control measures should be implemented is the 'Hierarchy of Controls'.

First, try to **eliminate** or **substitute** the risk.

Eliminating the risk altogether is obviously the most effective method of control. If this cannot be done, try substituting something that presents a lower risk, e.g. a less hazardous abrasive.

If that cannot be done, use **isolation/engineering controls**.

This could involve some structural change to the work environment or work process to place a barrier to, or interrupt the transmission path between the worker and the risk. For example conducting work in a blasting chamber.

If these cannot be implemented, use **administrative controls**.

These reduce or eliminate exposure to a hazard through procedures or instruction. They depend for success on appropriate human behaviour and include showering, washing hands and face before eating, drinking or smoking, and changing clothes after work has been completed.

As a last resort, use **personal protective equipment** (PPE).

PPE is worn by people as a barrier between themselves and the risk. The success of this control is dependent on the protective equipment being chosen, worn and used correctly. Examples of PPE include blast helmets, ear plugs, protective blast suits and work boots.

You should attempt to select control measures from the top of this hierarchy where possible, but it is often necessary to use a combination of measures.

Apply and monitor the controls

Control measures should be monitored, on a regular basis to ensure their effectiveness. When you implement risk control measures to address a particular risk, take care that the controls do not create new risks or hazardous situations themselves.

Record keeping

For the best results from the risk management process, the results of these steps should be recorded and kept for future reference. Records will also help to show that you have been actively working to ensure workplace health and safety at your workplace, should you need to prove this.

Risk assessment form

Please photocopy a separate sheet for each hazard

Description of hazard: _____

_____

_____

On the following chart, circle the most likely harm to a person if the risk happens (along the top). Next circle how often in **could** happen (down the right hand side). The risk priority (score) is the number where the two intersect.

Risk priority chart			
Probability How likely could it happen?	Consequence How severely could it hurt someone?		
	Catastrophic Kills, disables	**Major** Significant injury	**Minor** First aid only
	Permanent injury	**Not permanent**	**No lost time**
Very likely Could happen frequently	1	2	2
Likely Could happen occasionally	2	3	4
Unlikely Could happen rarely	3	4	5
Very unlikely Could happen, probably never will	4	5	6

What is the risk priority? (score from 1-6 from the above chart). If you score a:

- '1 or 2', do something **now**
- '3 or 4', do something soon
- '5 or 6', do something to address the risk.

Choose control measures from the highest possible level in the following list:

1. elimination,
2. substitution,
3. isolation or engineering,
4. administrative, or
5. personal protective equipment.

Control measures

Action to take:

Now: _____

_____

_____

Later: (Date: / /) _____

_____

In many cases, the best method of control for health and safety risks in abrasive blasting and protective coating work will be a combination of methods (i.e. other methods of control in conjunction with PPE).

Additional references

General

1. *Workplace Health and Safety Act 1995*
2. *Workplace Health and Safety Regulation 2008*
3. Workplace Health and Safety Queensland
   a. 'A Quick Start to the Workplace Health & Safety Act 1995' (guide – www.worksafe.qld.gov.au)

Dusts

1. *Workplace Health and Safety Regulation 2008*
2. Part 16 - Hazardous Substances, Part 17 - Lead
3. *Hazardous Substances Code of Practice*
4. '*Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC:1003(1995)]'
5. *List of Designated Hazardous Substances* [NOHSC:10005(1999)]
6. *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)]
7. Australian Standard AS1319 Safety signs for the occupational environment
8. Australian and New Zealand Standard AS/NZS 1715 Selection, use and maintenance of respiratory protective devices
9. Australian and New Zealand Standard AS/NZS 1716 Respiratory protective devices
10. Australian Standard AS 2985 Workplace atmospheres – Methods for sampling and gravimetric determination of respirable dust
11. Australian Standard AS 3544 Industrial vacuum cleaners for particulates hazardous to health
12. Australian Standard AS 3640 Workplace atmospheres – Methods for sampling and gravimetric determination of inspirable dust
13. Australian Standard AS 4361.1 Guide to lead paint management – Industrial applications

Noise

1. *Workplace Health and Safety Regulation 2008*, Part 12 - Noise
2. *Noise Code of Practice*

Particulate matter

1. Australian and New Zealand Standard AS/NZS 1336 Recommended practices for occupational eye protection
2. Australian and New Zealand Standard AS/NZS 1337 Eye protectors for industrial applications
3. Australian and New Zealand Standard AS/NZS 1715 Selection, use and maintenance of respiratory protective devices
4. Australian and New Zealand Standard AS/NZS 1716 Respiratory protective devices
5. Australian and New Zealand Standard AS/NZS 1269 Occupational noise management
6. Australian and New Zealand Standard AS/NZS 1270 Acoustics – Hearing protectors

7. Australian and New Zealand Standard Series AS/NZS 2161 Occupational protective gloves
8. Australian and New Zealand Standard AS/NZS 2210 Occupational protective footwear

Abrasive blasting plant and equipment

1. *Electrical Safety Regulation 2002* - Part 5 - Electrical Installations
2. *Plant Code of Practice*
3. Manufacturers' instruction manuals
4. Australian and New Zealand Standard AS/NZS 1200 Pressure equipment
5. Australian and New Zealand Standard AS/NZS 1336 Recommended practices for occupational eye protection
6. Australian and New Zealand Standard AS/NZS 1337 Eye protectors for industrial applications
7. Australian and New Zealand Standard AS/NZS 1715 Selection, use and maintenance of respiratory protective devices
8. Australian and New Zealand Standard AS/NZS 1716 Respiratory protective devices
9. Australian and New Zealand Standard Series AS/NZS 2161 Occupational protective gloves
10. Australian and New Zealand Standard AS/NZS 2208 Safety glazing materials in buildings
11. Australian and New Zealand Standard AS/NZS 2210 Occupational protective footwear
12. Australian and New Zealand Standard Series AS/NZS 2381 Electrical equipment for explosive gas atmospheres
13. Australian and New Zealand Standard AS/NZS 3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)
14. Australian and New Zealand Standard AS/NZS 3788 Pressure equipment- In-service inspections

Protective coatings and solvents

1. *Workplace Health and Safety Regulation* 2008
   a. Part 12 - Noise, Part 16 – Hazardous substances (in particular, Division 5 - Spray painting with hazardous substances) and Part 17 - Lead
2. *Electrical Safety Regulation 2002* - Part 5 - Electrical Installations
3. *Noise Code of Practice*
4. *Plant Code of Practice*
5. Australian and New Zealand Standard AS/NZS 1020 The control of undesirable static electricity
6. Australian Standard/New Zealand Standard series AS/NZS 1269 Occupational noise management
7. Australian Standard AS/NZS 1270 Acoustics-Hearing protectors
8. Australian Standard AS/NZS 1336 Recommended practices for occupational eye protection
9. Australian and New Zealand Standard AS/NZS 1337 Eye protectors for industrial applications
10. Australian and New Zealand Standard AS/NZS 1715 Selection, use and maintenance of respiratory protective devices

11. Australian and New Zealand Standard AS/NZS 1716 Respiratory protective devices
12. Australian Standard AS 1940 The storage and handling of flammable and combustible liquids
13. Australian and New Zealand Standard AS/NZS 2210 Occupational protective footwear
14. Australian Standard AS 2268 Electrostatic paint and powder spray guns for explosive atmospheres

Manual tasks

1. *Manual Tasks Code of Practice*
2. *National Code of Practice for Manual Handling* [NOHSC:2005(1990)]

Confined spaces

1. *Workplace Health and Safety Regulation 2008*
2. Part 18 - Confined Spaces
3. Workplace Health and Safety Queensland
   a. 'A guide to working safely in confined spaces' (guide – www.worksafe.qld.gov.au)
4. Australian New Zealand Standard AS/NZS 2865 Safe working in a confined space

Working at heights

1. Australian Standard AS 1418.10 Cranes, hoists and winches - Elevating work platforms
2. Australian and New Zealand Standard AS/NZS 2210 Occupational protective footwear

Slips, trips and falls

1. *Workplace Health and Safety Regulation 2008*
2. *Part 20 Construction work, div 2, sdiv12 – Principal contractor's obligation for amenities*
3. Australian Standard AS 1319 - Safety signs for the occupational environment
4. Australian and New Zealand Standard AS/NZS 3661.2 Slip resistance of pedestrian surfaces – Guide to the reduction of slip hazards

Vibration

1. *Plant Code of Practice*
2. Australian Standard AS 2670.1 Evaluation of human exposure to whole-body vibration – General requirements
3. Australian Standard AS 2763 Vibration and Shock – Hand-transmitted vibration – Guidelines for measurement and assessment of human exposure

Heat

1. Workplace Health and Safety Queensland. ' Heat Stress' http://www.worksafe.qld.gov.au

Risk management

1. Australian and New Zealand Standard AS/NZS 4360 Risk management

Other legislation and guidelines

Other legislation which is important to abrasive blasting and protective coating activities includes:

Work activities

- The *Environmental Protection Act 1994* – Schedule 2 (Notifiable activities)
- The *Environmental Protection Act 1994* – Chapter 7, Part 8 (Contaminated land)

You should contact your local authority for environmental guidelines. (In many cases local authorities have adopted the Operators Compliance Guidelines for Abrasive Blasting and the Operator Compliance Guidelines for Metal Surface Coating.)

Waste management

- The *Environmental Protection (Waste Management) Regulation 2000*
- The *Environmental Protection (Waste Management) Policy 2000*
- The *Environmental Protection Regulation 1998* Schedule 1 (Level 1, Item 23 Abrasive Blasting and Item 25 Metal Surface Coating) and Schedule 7 (Regulated Wastes)
- The Australian Code for the Transportation of Dangerous Goods by Road and Rail (ADG Code) and associated state legislation.

Abrasive materials

- *Radiation Safety Act 1999*
- *Radiation Safety Regulation 1999*
- *Radiation Safety (Radiation Safety Standards) Notice 1999*

How to get copies of this code

Hard copies of this code of practice can be obtained through:
SDS Publications
371 Vulture Street
Woolloongabba Qld 4102.
Telephone: (07) 3118 6900

The *Abrasive Blasting Code of Practice* is available on the Department of Employment and Industrial Relations website at www.worksafe.qld.gov.au. This site provides access to the workplace health and safety legislation (*Workplace Health and Safety Act 1995*, *Workplace Health and Safety Regulation 2008* and *Codes of Practice*) and guidance materials produced by Workplace Health and Safety Queensland.