

Foundry

In order to understand the workplace health and safety requirements for foundry, and your obligations under the law you must consider and understand relevant legislation and codes of practice.

What law applies

Legal obligations, legislation, codes of practice, guides

What is foundry work?

Types of foundries and foundry processes

Foundry health hazards and solutions

Heat, hazardous substances, dangerous goods, airborne contaminants, manual tasks, noise and vibration, molten metal, plant and machinery, and electricity

What law applies

In order to understand the workplace health and safety requirements for formwork, and your obligations under the law you must consider and understand relevant legislation and codes of practice.

General health and safety obligations

To understand your obligations and safety requirements you must be familiar with the:

Workplace Health and Safety Act 1995 which imposes obligations on people at workplaces to ensure workplace health and safety. The *Workplace Health and Safety Act 1995* also helps you to meet your workplace health and safety obligations through:

- The *Workplace Health and Safety Regulation 2008* which describes what must be done to prevent or control certain hazards which cause injury, illness or death
- codes of practice, which are designed to give practical advice about ways to manage exposure to common risks. In particular, the *Risk Management Code of Practice 2007* should be read in conjunction with information on PPE.

Every Queensland employer must have **workers' compensation** insurance. Most employers insure with WorkCover Queensland, while a small number of large organisations have their own insurance. This insurance coverage ensures that employees injured at work receive financial support.

What you must do

It is a requirement of the *Workplace Health and Safety Act 1995* that risks must be assessed and control measures then implemented and reviewed to prevent or minimise exposure to the risks.

If the *Workplace Health and Safety Regulation 2008* describes how to prevent or minimise a risk at your workplace you **must** do what the regulation says. If there is a code of practice that describes how to prevent or minimise a risk at your workplace you **must** do what the code says or adopt and follow another way that gives the same level of protection against the risk.

If there is no regulation or code of practice about a risk at your workplace you **must** choose an appropriate way to manage exposure to the risk. People must, where there is no regulation or code of practice about a risk, take reasonable precautions and exercise proper diligence against the risk.

See the *Risk Management Code of Practice 2007* for further information.

Specific codes of practice for formwork

Please note, from 18 November 2004 the *Workplace Health and Safety Act 1995* was amended so that:

- all advisory standards that were in force on that day were continued as codes of practice and now expire 10 years after their commencement; and
- all existing industry codes of practice that were in force on that day now expire 10 years after their commencement.

The *Formwork Advisory Standard 2004* states ways to plan, erect and strip formwork and place concrete on the formwork to manage exposure to the risk of injury from the collapse of formwork.

What is foundry work?

Foundry work occurs in a very hot, noisy and potentially dangerous environment.

Deafness, lung cancer and respiratory problems are just some of the serious health problems workers can get if they are regularly exposed to excessive heat, noise and hazardous substances.

It is important that workers are provided with properly designed and guarded machinery, adequate ventilation, and appropriate personal protective equipment.

Foundry work is the process of making a metal casting of an object by pouring molten metal into a mould. The mould is made using a pattern of the article required.

There are two types of foundries, which are:

- **ferrous foundries**, which produce iron and steel castings
- **non-ferrous foundries**, which produce castings of copper-based alloys (brass, bronze), aluminium-based alloys (lead, zinc, nickel, magnesium) and other alloys

Foundry work involves numerous processes, including:

- pattern making
- core making, stoving, blowing and shooting
- mould making
- refining or alloying
- furnace and ladle maintenance
- spectrographic analysis
- metal pouring
- casting knockout
- abrasive blasting
- sand reclamation

To find out more detailed information about the processes undertaken in the different areas of foundries, refer to introduction section of the *Foundry Industry Code of Practice 2004*.

Foundry health hazards and solutions

The main hazards in the foundry industry include:

- heat
- hazardous substances and dangerous goods
- gases, vapours, dust and fumes
- manual tasks
- noise and vibration
- molten metal
- plant, machinery and electricity

Heat

The furnaces and molten metal in a foundry create a hot working environment.

Dehydration, heat cramps, heat exhaustion and heat stroke are some of the health effects foundry workers can experience from exposure to excessive heat. Workers may also develop eye cataracts from infrared and ultraviolet radiation which can be emitted when pouring white hot metal.

Removing unnecessary sources of radiant heat and changing the work environment will help reduce heat in work areas. Some solutions include:

- using insulation and shielding to reduce radiant heat emissions from hot surfaces and plant
- using local ventilation, spot coolers, blowers, fans, air-conditioning and flues to reduce the air temperature
- automating and mechanising as many tasks as possible
- putting in place administrative measures, including rescheduling hot work, giving regular work breaks in cool areas, job sharing and rotation, and acclimatisation
- providing access to clean, cool fresh water
- using personal protective equipment such as eye wear, heat reflective clothing, gloves and footwear

To find out more about how to work safely in heat, check working in heat section of the *Foundry Industry Code of Practice 2004*.

Hazardous substances and dangerous goods

Hazardous substances

Hazardous substances are widely used in foundries. Exposure to hazardous substances like formaldehyde and amines can have a damaging effect on the health of foundry workers if they are not properly protected.

Hazardous substances can enter the body through inhalation, skin contact or by mouth.

Ways to help protect workers from exposure to hazardous substances include using:

- physical processes like ultra-sound, rather than chemical processes, to clean an object
- ready-cut and sized form material to avoid dust production from cutting material on site
- less hazardous substances, forms or processes, for example using a granular form instead of powder
- a separate restricted access room for the mixing and use of epoxy resins in pattern making
- exclusion zones around work areas to restrict access
- local exhaust ventilation to remove contaminated air directly from the source
- shift or work rotation, safe storage and disposal of hazardous substances, strict personal hygiene practices, proper washing facilities and regular maintenance of ventilation and exhaust systems
- personal protective equipment where exposure to hazardous substances cannot be prevented or reduced by any other way

Read more about the main hazardous substances used in foundries in appendix 1 of the *Foundry Industry Code of Practice 2004*.

To find out more about protecting yourself and others, check:

- Hazardous substances section of the *Foundry Industry Code of Practice 2004*
- *Hazardous Substances Advisory Standard 2003* (now known as a Code of Practice)

Dangerous goods

Dangerous goods that are not stored and handled properly have the potential to cause fire, explosion, corrosion, radioactivity, toxicity, asphyxiation or environmental harm.

The safe management of dangerous goods involves:

- identification of dangerous goods and site classification

- provision of information, training and supervision
- control of ignition sources where flammable atmospheres may exist
- segregation of incompatible goods
- separation of dangerous goods from 'protected places'
- spills management
- provision of safety equipment and personal protective equipment
- use of documented safety management systems

For example, to avoid the possibility of an explosion or the emission of toxic flammable or corrosive gases:

- store two incompatible goods at least 3m apart
- where the goods could react violently, store them at least 5m apart or
- use fire rated, vapour proof, task-specific physical barriers

Refer to appendix 2 of the *Foundry Industry Code of Practice 2004* for examples of stated dangerous goods or combustible liquids used in foundry operations.

Foundry occupiers need to check the *Foundry Industry Code of Practice 2004* for:

- **examples**, refer for appendix 2 of the *Foundry Industry Code of Practice 2004*, of dangerous goods or combustible liquids used in foundry operations
- their obligations for the **storage and handling**, refer to dangerous goods section of the *Foundry Industry Code of Practice 2004*, of dangerous goods and combustible liquids

Gases, vapours, dust and fumes

Gases and vapours

Numerous gases and vapours can be found in foundries including ammonia, chlorine, nitrogen, toluene and formaldehyde.

Exposure to such gases and vapours can result in various adverse health effects, such as respiratory irritation, asthma and watery eyes.

Workers in all areas of a foundry need to be adequately protected.

To find out more about protection options, check control measures for airborne contaminants section of the *Foundry Industry Code of Practice 2004*.

Dust and fumes

Foundry operations create dusty conditions exposing workers to various health effects.

Chronic diseases (such as silicosis, lung or nasal cancer) are linked to exposure to silica or fumes in a foundry.

High airborne concentrations of wood dusts can also contribute to an explosion.

Examples of ways to reduce the risks from airborne contaminants include:

- using wet or vacuum methods, or brushes to remove loose dust or sand rather than compressed air
- enclosing major emission points, such as conveyor belt transfer areas
- installing high-energy scrubbers and bag houses
- using canopy hoods or other special hoods near the furnace doors to capture contaminants and re-route them through an emission control system
- continuous monitoring of carbon monoxide levels in the work area to ensure airborne contaminants are within the Workplace Exposure Standard (WES)
- providing respiratory protection appropriate to the contaminant

To find out more about how to reduce workers' exposure to airborne contaminants, check **control measures** section of the *Foundry Industry Code of Practice 2004*.

Manual tasks

Manual tasks are common in most areas in a foundry including:

- pattern and core making
- moulding and fettling shops
- stores and dispatch
- inspection and surface coating areas

Workers lifting loads, working in a fixed position or doing repetitive work can, suddenly or over time, damage their upper and lower back and shoulders.

Ways to reduce the risk of injury include:

- redesigning the work processes or the physical work area
- using mechanical lifting devices
- providing task-specific training
- using personal protective equipment
- ensuring tools and equipment are regularly maintained
- ensuring adequate numbers of workers to do the work
- giving workers adequate rest breaks and work variety

To find out more about how to do manual tasks safely, check:

- Manual tasks section of the *Foundry Industry Code of Practice 2004*
- *Manual Tasks Advisory Standard 2000* (now known as a Code of Practice)

Noise and vibration

Noise and vibration often occur together in a foundry environment.

Noise

In the foundry industry people are subjected to a variety of noise sources. High noise levels from sources, such as vibrator systems to compact moulding sands in moulds, arc/air gouging and fettling activities and particularly those of short duration, such as impulse or impact noise, are present in many foundries and are capable of causing damage to hearing.

Foundries form part of the metal fabrication industry. This industry is responsible for a large proportion of worker's compensation payouts for noise induced hearing loss of its workers.

In foundries noise levels can be expected to range generally between about 80 and 110dB(A). Most common noise sources are from mould vibrators, shake outs, rumblers and shot blasting, arc gouging and fettling and dressing of castings, using angle grinders and hammering and banging on castings.

Operator noise exposure levels from the above sources, of between 96 – 102dB(A), as average over the shift duration, are not uncommon in this industry. Noise sources may also be found from induction furnaces. The frequent use of compressed air systems to clean moulds or work benches, cause high noise levels consisting of predominantly high pitched components.

A variety of woodworking machines in the making of mould patterns also add to the noise exposure. All of these noise sources combine to create high ambient noise levels in foundries and the use of personal hearing protectors is required in most situations.

Generally where high levels of noise are present throughout the work shifts, workers do tend to wear personal hearing protectors most of the time. However, with short duration noises, for example, a few belts with a hammer on a metal casting or using compressed air to clean a mould or work bench, the use of hearing protectors is often ignored or simply not even thought of. These relatively short duration exposures however, happen many times per shift and add to the overall exposure.

Typical noise sources

Some typical noise sources in the foundry industry at operator ear level include:

Mould vibrators	85 - 114dB(A)
Inverter	83 - 116dB(A)
Arc/air gouging	82 - 107dB(A)
9 inch angle grinder	97 - 110dB(A)

Shot blasting	86 -101dB(A)
Shake out	84 -95dB(A)

Noise control measures

Risk management must be applied through a hierarchy of control measures, ie. elimination, substitution, engineering and/or administrative controls, and as a last resort, (or as an interim measure or in conjunction with other control options), reliance on protective equipment.

It is important that foundry operators have a noise control policy and hearing conservation program in the workplace to manage noise levels in the foundry environment.

Examples of **engineering noise control measures** include:

- installing modifications such as rotary vibrators
- installing vibration isolating mountings
- locating noisy equipment such as automatic moulding machines and vibrators in separate enclosures
- providing a sound proof enclosure for operators
- installing improved mould design that can eliminate or drastically reduce the amount of excess metal to be removed after casting. This in turn removes or reduces the need for fettling
- using low noise, or noise reduced, grinding discs. This can reduce the noise levels by up to 5dB(A)
- “buffer” mould boxes where automatic lines are used in order to reduce striking noise from boxes on conveyers
- fitting suitable silencers to compressed airlines
- lining mobile enclosures internally with 75 mm sound absorbent material such as mineral wool where noisy work has to be carried out. This could reduce operators exposures by about 5 to 20dB(A) depending on construction etc. The additional effect is also to reduce the exposures of nearby workers.

Examples of administrative noise control measures include:

- introducing a “buy quiet” policy
- training workers, for example fettlers, about noise issues
- sign-posting noisy areas
- maintaining equipment
- reducing the amount of time operators spend in noisy areas through job rotation to reduce and control individual exposures from noisy work, for example, arc/air gouging and fettling activities

Where noise control cannot be achieved through these measures an employer must provide suitable personal hearing protectors as well as proper instruction in their use so that exposed workers can perform their work in a manner which is safe and without risks to their health and safety.

For more information on how to deal with noise issues, refer to:

- Noise section of the *Foundry Industry Code of Practice 2004*
- *Noise Advisory Standard 2004* (now known as a Code of Practice)

Vibration

Foundry workers may be exposed to whole-body vibration and hand-arm vibration.

The health effects of vibration can include blood pressure and heart problems, nervous disorders, and blanching and numbness in the fingers.

Control measures for vibration include:

- purchasing vibration reduced equipment
- using tools with vibration dampers
- avoiding prolonged use of vibrating equipment
- providing protective gloves

For more information on how to deal with vibration issues, refer to vibration section of the *Foundry Industry Code of Practice 2004*.

Molten metal

Workers who work with or near molten metal could come into contact with metal splashes and electromagnetic radiation.

Splashes, sparks, radiant heat and radiation from molten metal can result in serious burns and eye damage, including cataracts.

Barriers and other suitable shields should be used or installed to protect workers against molten metal splashes and electromagnetic radiation.

To find out more about how to prevent exposure to molten metal, check molten metal section of the *Foundry Industry Code of Practice 2004*.

Plant, machinery and electricity

Plant and machinery

Wood cutting and finishing machines, mechanical handling devices and grinders are some of the plant and machinery used in foundries.

Cuts and lacerations, amputations and burns are some of the injuries that can result from poor maintenance, repair and guarding and use of such plant and machinery.

Some ways to prevent injury from plant and equipment include:

- replacing existing machines with ones that have better guarding
- enclosing or guarding dangerous machines

- neutralising potential energy sources during maintenance and repairs
- providing personal protective equipment

For more information on how to deal with noise issues, refer to:

- Noise section of the *Foundry Industry Code of Practice 2004*
- *Plant Code of Practice 2005*

Electricity

Electricity can cause death or serious injury.

Some ways to prevent death or injury from electricity include:

- prohibiting work on live equipment or installations without proper safeguards in place
- providing safety switches
- prohibiting the use of double adapters or piggyback plugs
- using insulating gloves.

There is more information available on electrical safety website.

Electricity section of the *Foundry Industry Code of Practice 2004* provides more information on electrical hazards in foundries.