

Your health and safety guide to Foundries



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www.worksafe.vic.gov.au
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Foundries are high-risk environments that pose serious hazards to workers' health and safety.

While there are obvious dangers associated with casting molten metal, foundry workers are also exposed to a significant number of less obvious hazards.

Typically, foundry work is physically demanding and often takes place in difficult conditions, exposing workers to a range of potential injuries and illnesses, including lung disease, hearing loss, musculoskeletal disorders, occupational induced cancers, serious burns and lacerations, fractures and contusions (bruises).

This guide will help you understand the risks of working in foundries, and will explain what you need to do to make your workplace safe.



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Glossary

About the industry

What is foundry work?

Foundry work mostly involves the casting of molten metal into a mould. This is often done by hand (i.e. static casting), but is also commonly automated by using injection, die or continuous casting processes.

A typical process includes:

- preparing a mould casting
- melting and pouring metal into the mould
- removing the casting
- finishing the casting.

Ferrous foundries produce iron and steel castings, while non-ferrous foundries produce castings of copper-based alloys, aluminium-based alloys and other alloys.

What are the risks?

There are many different risks in foundries because of the hazardous and diverse nature of the work.

One of the most serious threats to employees' health is breathing in silica dust, which can cause silicosis, a chronic lung disease that can be fatal. Breathing in other airborne contaminants, such as wood and metal dusts, can also damage the body's respiratory system.

Other hazards and risks may include:

- heat stress and fatigue from hot working conditions
- burns from explosions of molten metal
- respiratory disorders from exposure to dangerous fumes and gases, including heavy metal oxides such as cadmium and zinc
- heat stroke from working in hot conditions
- back and muscle sprains and strains (musculoskeletal disorders) from various tasks
- vibration-induced health effects caused by prolonged use of tools and machinery
- eye injuries from metal fragments
- excessive noise levels
- plant and machinery.

Your legal duties

The law

Occupational Health and Safety Act 2004 (OHS Act)

The OHS Act came into effect on 1 July 2005. It sets out the key principles, duties and rights in relation to occupational health and safety. The duties imposed by the Act cover a wide variety of circumstances, recognising the need for a duty-holder to have flexibility in determining what needs to be done to comply.

The OHS Act is based upon the following key health and safety principles:

- All people – employees and the general public – should have the highest level of protection against risks to health and safety.
- Those who manage or control things that create health and safety risks in the workplace are responsible for eliminating or reducing the risks, so far as is reasonably practicable.
- Employers should be proactive in promoting health and safety in the workplace.
- Information and ideas about risks and how to control them should be shared between employers and employees.
- Employees are entitled – and should be encouraged – to be represented in relation to health and safety issues.

Occupational Health and Safety Regulations 2007 (OHS Regulations 2007)

New Regulations for occupational health and safety came into effect on 1 July 2007.

The specific hazards part of the OHS Regulations is intended to prevent injuries and deaths from known hazards in the workplace.

In relation to foundry work, the Regulations impose specific legal responsibilities on employers and employees for the control of hazards.



Employers

By law, employers must provide a safe working environment for their workers, as far as reasonably practicable.

This means you must eliminate any risks to health and safety, as far as reasonably practicable and, if it's not reasonably practicable to eliminate the risks, you must reduce them as far as practicable.

There are also specific duties that must be complied with in relation to the following hazards:

- hazardous substances
- noise
- plant and machinery
- manual handling.

Employees

Your employer is required to protect you from risks in the workplace.

At the same time, you have a general duty to take reasonable care for your own health and safety, and that of others who may be affected by your work, and to cooperate with your employer's efforts to make the workplace safe.

Compliance and enforcement

WorkSafe applies a strategy of 'constructive compliance' – a combination of incentives and deterrents – to improve workplace health and safety.

This strategy recognises that real and sustainable improvement in workplace health and safety requires active involvement from employers and employees in identifying hazards and controlling risks.

WorkSafe inspectors have the primary role of targeting unsafe workplace activity, enforcing compliance with health and safety laws, and providing guidance and advice on how to comply with those laws.

Further information on workplace inspections and WorkSafe's enforcement policy is available through the WorkSafe Advisory Service (1800 136 089) or at www.worksafe.vic.gov.au

How to comply

WorkSafe has a range of guidance materials to advise on the required processes and actions that duty-holders must take in order to meet their legal obligations. *Compliance Codes, Health and Safety Solutions* and *Guidance Notes* each provide detailed and specific advice for duty-holders seeking to comply with the OHS Regulations. See also the enclosed *More information* sheet for a listing of guidance materials related to Foundries.

Consult

Employees' expertise can make a significant contribution to improving workplace health and safety.

Regular, proactive consultation can help identify issues in the workplace and build a strong commitment to health and safety by including all views in the decision-making process.

Under the OHS Act, employers must consult with employees when identifying and assessing hazards or risks associated with foundries, and making decisions about risk control.

'Employees' includes independent contractors (and any employees of the independent contractor(s)) who perform work which the employer has, or should have, control over.

If employees are represented by health and safety representatives, the consultation must involve those representatives – see *Your health and safety guide to Consultation* for further information.



Find

There are many potential hazards involved in foundry work and you need to think about both your work practices and equipment when identifying things that could go wrong.

Hot conditions

Work involving furnaces and molten metal can create a very hot working environment for employees in foundries.

Hot conditions can contribute to fatigue and a lack of alertness among workers, with furnace workers, metal pourers, welders, arc-air operators, oxy-cutters and crane operators particularly at risk.

Hazardous substances

Hazardous substances in foundries are commonly used in pattern-making, mould-making, core-making, casting and protective coating.

The types of substances used include amines, benzene, hexachloroethane, ammonia, epoxy resins, formaldehyde, furfuryl alcohol, isocyanates, mould-release paints, protective coatings and phenol.

You should consult the MSDS for each substance to help ensure that you use them safely.

Airborne contaminants

Silica dust, which can cause serious lung disease, comes from the quartz in sand and is generated during mixing, moulding, shakeout and dressing processes, and during sand reconditioning.

Dangerous gases, vapours, fumes and dusts can be generated from processes such as:

- scrap preparation using heat and solvent degreasers (carbon monoxide)
- the melting process (carbon monoxide, sulphur dioxide, nitrogen oxide, chloride and fluoride compounds)
- the treatment and inoculation of molten metal before pouring
- core and mould-making processes during sand reclamation, preparation and mixing
- organic chemicals used as solvents, paints, binders and catalysts produce vapours through natural evaporation, heating or spraying.

How to comply continued

Manual handling

Workers in most areas within a foundry perform some form of manual handling.

Common tasks include:

- lifting bags of sand
- handling heavy castings
- twisting and bending to pick up cores
- lifting castings out of product bins
- prying open permanent mould dies
- manually moving heavy core racks.

Noise

There are a wide variety of noise sources in the foundry industry, which can contribute to dangerous noise levels for employees.

Sources include:

- machinery used for pattern-making, moulding and core-making (e.g. saws, pattern vibrators, fans, pneumatic equipment and gas jets)
- furnaces
- shakeout and knockout of castings
- machinery used in tumbling, grinding and cleaning of castings
- fettling and dressing of castings.

Vibration

Foundry workers can suffer serious health effects as a result of prolonged vibration from tools and work processes.

Whole-body vibration can occur during shakeout processes, sand-slinging, and from forklift truck, conveyor, overhead crane, pneumatic ramming operations and jolt-squeeze machines. Hand-arm vibration occurs when using hand-held power grinders, chippers and other pneumatic tools.

Molten metal

The use of molten metal involves significant risks for workers who may come into contact with metal splashes and can be exposed to electromagnetic radiation.

Metal and metal slag must not come into contact with water or moisture, as this can result in an explosive reaction or ejection of molten metal.

Activities that involve the risk of hot metal splashes include:

- charging a furnace with contaminated or moist scrap metal and alloys
- using moist tools, moulds or other material when contacting molten metal
- tapping or pouring the molten metal into a holding furnace, tundish or ladle
- slagging or raking operations
- pouring molten metal from ladles into moulds.

Plant and machinery

A wide range of plant and machinery is used in foundry work, including wood-cutting and finishing machines, moulding and core-making machines, cranes, hoists and grinders.

The hot working environment in foundries can put greater stress on machinery components and this should be taken into account when scheduling maintenance and repairs.

Electricity

Workers can suffer electric shock from direct contact, through a medium or by arcing. The chances of workers receiving an electric shock may increase due to excessive sweating when working in hot conditions.

Arcing, explosion or fire can also result in serious burns, and in some cases can release gases and contaminants, such as ozone, cyanide and sulphuric acids.

Fix

After you have identified the hazards in your workplace, you need to control them to ensure your workplace is safe.

Some examples of common control measures include:

Hot conditions

- eliminate sources of water vapour (e.g. steam valve leaks)
- reduce radiating heat from plant by insulation and shielding
- use ventilation (e.g. install flues extending from a foundry to the open air)
- prohibit entry to furnace areas when the temperature exceeds 50°C, except in emergencies
- carry out hot work at cooler times of the day and drink plenty of water.

Hazardous substances

- use a physical process rather than a chemical process for cleaning
- replace adhesives with clips, clamps or bolts
- use water-based instead of solvent-based coatings
- mix epoxy resins in a room with restricted access
- capture fumes using a ventilation hood.

How to comply continued

Airborne contaminants

- replace silica sand with chromite sand
- use wet or vacuum methods rather than compressed air to minimise dust creation when removing loose dust or sand in the mould-making process
- enclose major emission points, such as conveyor belt transfer areas
- install canopy hoods near the furnace doors and tapping outlets to capture contaminants and direct them through an emission control system
- monitor the levels of carbon monoxide in the work area.

Manual handling


- move cores from a conveyor belt using a trolley
- use hoists, cranes, scissor lifts and forklifts
- install a hydraulic opening system for permanent mould dies
- use a pneumatic ram to feed ingots into the furnace rather than doing it by hand.

Noise

- replace noisy machinery with quieter equipment
- implement design changes, such as replacing metal components with plastic ones
- provide soundproof enclosures for operators
- improve mould design to reduce the amount of excess metal that needs to be removed after casting
- replace piston-type vibrators with turbine and rotary vibrators.

Vibration

- use light tools with vibration dampers
- apply vibration-dampening material to handles (e.g. lagging with soft resilient rubber)
- organise job rotation to avoid prolonged use of vibrating equipment
- service machinery regularly to eliminate vibration due to bent shafts and worn bearings
- use padded protective gloves.



Molten metal

- Install barriers and other suitable shields to protect workers from molten metal splashes and electromagnetic radiation
- prevent molten metal coming into contact with water or other contaminants
- ensure all ladles and other equipment used for handling metal are completely dry and rust-free before they come into contact with molten metal
- restrict access to the furnace and pouring section using barriers and signage
- provide heat-resistant clothing, eye protection with side-shields, and special UV and infra-red glasses.

Plant and machinery

- replace existing machines with those that have better safety devices, and use guarding on dangerous moving parts, such as flywheels, gearing equipment and belt and pulley drives
- neutralise all potential energy sources during maintenance and repairs
- provide eye glasses or goggles to protect against ejected materials.

Review

It's important to review your risk controls regularly to ensure they are implemented correctly and to monitor their effectiveness. You should review (and, if necessary, revise) your risk controls whenever any changes are made to the work or the workplace, such as changes to the way work is done or to the tools or equipment used.

GLOSSARY

Administrative control – Using methods such as policies, procedures, safety signs, training or supervision, or a combination of methods, to control risk.

Employee – A person employed under a contract of employment or contract of training.

Employer – A person who employs one or more people under contracts of employment or contracts of training.

Ferrous foundry – A foundry which produces castings of iron or steel.

Hazard – A potential source of harm or injury. The potential to cause injury, illness or disease.

Hazardous substance – A substance that has the potential to harm people's health. The substance can be solid, liquid or gas, and when used in the workplace, is often in the form of fumes, dusts, mists and vapours.

Health and safety representative (HSR) – A member of a designated work group elected to represent employees on matters relating to occupational health and safety.

Manual handling – Any activity requiring the use of force exerted by a person to lift, push, pull, carry or otherwise move, hold or restrain any object.

Material safety data sheet (MSDS) – An MSDS provides the information needed to allow the safe handling of hazardous substances used at work. Information on the properties of the substance, the toxicity, reactivity and the precautions for safe use are included in the MSDS.

Musculoskeletal disorder (MSD) – An injury, illness or disease that arises in whole or in part from manual handling in the workplace, whether occurring suddenly or over a prolonged period of time.

Non-ferrous foundry – A foundry which produces castings of copper-based alloys, aluminium-based alloys and other alloys.

Personal protective equipment – Equipment or clothing used to provide protection, e.g. gloves, safety glasses, hard hats, goggles, earmuffs, safety shoes, respirators and fall arrest systems.

Plant – Any machinery, equipment, appliance, implement and tool; and any component of any of those things; and anything fitted, connected or related to any of those things.

Reasonably practicable – See section 20(2) of the OHS Act and the WorkSafe Position on *How WorkSafe applies the law in relation to reasonably practicable*.

In this series

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- Your health and safety guide to asbestos
- Your health and safety guide to confined spaces
- Your health and safety guide to dangerous goods
- Your health and safety guide to falls prevention
- Your health and safety guide to hazardous substances
- Your health and safety guide to lead
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- Your health and safety guide to noise
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Industries

- Your health and safety guide to construction
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- Your health and safety guide to major hazard facilities
- Your health and safety guide to mines

Subjects

- Your health and safety guide to communicating across languages
- Your health and safety guide to consultation
- Your health and safety guide to controlling OHS hazards and risks
- Your health and safety guide to licensing and registrations
- Your health and safety guide to workplace amenities and first aid

Visit www.worksafe.vic.gov.au for online guidance on all of these topics and more...

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WorkSafe Victoria

WorkSafe Advisory Service

222 Exhibition Street
Melbourne VIC 3000

Phone 03 9641 1444

Toll-free 1800 136 089

Email info@worksafe.vic.gov.au

Head Office

222 Exhibition Street
Melbourne VIC 3000

Phone 03 9641 1555

Toll-free 1800 136 089

Website www.worksafe.vic.gov.au

Local Offices

Ballarat 03 5338 4444

Bendigo 03 5443 8866

Dandenong 03 8792 9000

Geelong 03 5226 1200

Melbourne

(628 Bourke Street) 03 9941 0558

Mildura 03 5021 4001

Mulgrave 03 9565 9444

Preston 03 9485 4555

Shepparton 03 5831 8260

Traralgon 03 5174 8900

Wangaratta 03 5721 8588

Warrnambool 03 5564 3200