



Chapter 21

Welding

The hazard

The most common injuries linked with welding work are muscle sprains and strains (from awkward or difficult postures or heavy manual handling), eye injuries such as fine metal pieces or dusts and flash burns.

The very small particles formed when the vaporised metal condenses in air can cause both short- and long-term ill health - just what those effects are is dependent upon the metals and fluxes used.

Occupational exposure to welding fumes has been associated with metal fume fever, asthma, lung cancer, welder's pneumoconiosis, manganism and changes in the kidney due to cadmium.

Welding – carcinogenic to humans

In March 2017, scientists from around the world met at the International Agency for Research on Cancer (IARC; Lyon, France) classified welding as “Carcinogenic to Humans”. The scientists concluded that there is “sufficient evidence in humans” that welding fumes cause lung cancer and limited evidence for kidney cancer.

Metal fume fever

Zinc oxide fumes, typically produced when welding gal (galvanised steel), can cause an immediate flu-like illness called metal fume fever. Metal fume fever is also known as 'Monday morning fever' as the symptoms occur after the weekend away from the daily exposures to metal oxide fumes. The body develops a tolerance to the fumes with everyday exposure, but this is lost during the non-welding days. This is important, as damage can still be occurring to the lungs, without the welder experiencing any immediate symptoms.

21. Welding

The common symptoms are fever, chills, muscle aches, chest pain, a non-productive cough, metallic taste in the mouth, headache and fatigue. As these symptoms are very similar to those caused by the flu or a cold, the diagnosis can sometimes be missed. Metal fume fever symptoms develop within 48 hours of exposure and resolve within 1-2 days; some treatment may be necessary to relieve symptoms.

Other metal fumes produced by welding

The long-term exposure to iron oxide fumes is a contributor to metal fume fever:

- Manganese oxides are known to be chronic toxins with central nervous system effects – a slow deterioration of muscle control including walking and facial expression problems
- Manganese oxide toxicity typically becomes apparent after long term exposure to the fumes
- Nickel oxide is a known skin irritant and is classified as potentially causing lung and nose cancer.

Gases generated from welding

Carbon monoxide is a colourless gas and overexposure can inhibit the red blood cells' ability to carry oxygen in the blood. Ozone, nitrogen oxide and nitric oxide are produced by the interaction of ultraviolet light and air. These are irritating to the eyes, nose and throat.

Degreasing with chlorinated solvents can produce phosgene, hydrogen chloride etc. These also cause eye, nose and lung irritations. The symptoms may be delayed. Cleaning metal with pickling paste can produce toxic hydrogen fluoride and nitric acid.

The type and amount of fumes varies depending upon the composition of the metal being welded and the welding process (stick welding, MIG, fluxed core arc welding, TIG or submerged arc welding).

TIG welding produces less metal fumes than say MIG, but higher levels of ozone and nitric oxide.

The Regulations and Code

There are no Regulations for Welding – there is a Code which is useful – it contains what to do for:

- Confined spaces
- Electrical safety
- Fire and explosion
- Hazardous manual handling
- Hazardous substances – breathing in fumes
- Heat
- Injection injury
- Noise.

Some of these hazards are covered in this booklet – and relevant Australian Standards. Although IARC (see above) has classified welding as causing cancer in humans, Australian health and safety authorities have not taken any action to change their guidance information.

Australian welders miss out

If an Australian welder is exposed to the Australian workplace standard of 5 mg/m³ for welding fumes, that is 4 times the level of a known carcinogen than that of a German welder working under their regulations.

There is useful advice available from industry bodies such as Australian Welding Services which outline what type of ventilation and respiratory protection is required to prevent the inhalation of welding fumes.

Welding fumes

How much of these fumes and gases are breathed in by the welder depends on the ventilation – general dilution ventilation is not enough.

Respiratory protection

To protect against inhaling welding fumes in addition to forced exhaust ventilation, good respiratory protection is required – which normally requires a particle filter. In conditions where there is limited ventilation or restricted space then supplied air via regulator and filtration units are needed.

If the work also involves grinding or carbon arc gouging, the welder is much more likely to be exposed to hazardous levels of fumes and gases. This is a guide only.

Fume	Source	Health effects
Chromium	Most stainless steel and high alloy materials, welding rods, plating material	<ul style="list-style-type: none">• Asthma.• Skin irritation.• Eye and skin irritation.• Pneumonia-like illness.• Build-up of fluid in the lungs, with severe shortness of breath• Lung cancer

21. Welding

Fume	Source	Health effects
Aluminium	Some alloys, brass and filler materials	<ul style="list-style-type: none"> • Eye, nose, throat and lung irritation. • Headache • Upset stomach or vomiting. • Chest pain, shortness of breath • Tiredness • Chronic bronchitis and emphysema • Fibrosis of the lung.
Plastics, primers, grease fumes	Painted, dirty or insulated steels	<ul style="list-style-type: none"> • Hazards depend upon the nature of the coating • Clean contaminants and ensure that coatings are removed safely before welding • If the coating or grease cannot be removed, use local exhaust ventilation and airfed respirators.
Nickel fumes	Stainless steel especially high chromium stainless	<ul style="list-style-type: none"> • Skin allergies, harm to the blood and kidneys, chronic bronchitis, and reduced lung function • Cancer of the lung and nasal sinus.
Beryllium	Hardening agent in copper, magnesium, aluminium alloys and electrical contacts	<ul style="list-style-type: none"> • Metal fume fever • Cancer • Lung damage.
Lead	Solder, brass and bronze alloys, primer/coating on steel	<ul style="list-style-type: none"> • Damage to nervous system, kidneys, gut and mental capacity. Affects reproductive capacity of men and women and unborn babies • Increases risk of hearing loss.
Manganese	Most welding processes, especially high tensile steels	<ul style="list-style-type: none"> • Metal fume fever • May cause nervous system damage • Increased risk of hearing loss.
Zinc chloride fumes	Active soldering fluxes	<ul style="list-style-type: none"> • Eye and skin irritation.
Zinc	Galvanised and painted metal	<ul style="list-style-type: none"> • Metal fume fever (flu-like) symptoms: chills, thirst, fever, muscle aches, chest soreness, fatigue, gastrointestinal pain, headache, a metallic or sweet taste, nausea and vomiting.
Cadmium	Stainless steel containing cadmium or plated materials, zinc alloys.	<ul style="list-style-type: none"> • Kidney damage and emphysema • May cause cancer.