

Welding Processes: Metal Fumes, Gases and Vapours Exposure Limits

Substance	Current WES (until 30 November 2026) Source: Workplace exposure standards for airborne contaminants (2025) Safe Work Australia	New WEL (commencing 1 December 2026) Source: Workplace exposure limits for airborne contaminants Safe Work Australia	Health Effect Sources: Welding and Thermal Cutting Fume – Potential for Occupational Health Effects (2022) – AIOH https://www.safeworkaustralia.gov.au/doc/model-code-practice-welding-processes
Metals			
Welding fume	1mg/m ³ (8-h TWA)	1mg/m ³ (8-h TWA)	Known human carcinogen; chronic lung effects (Koh <i>et al</i> , 2015); metal fume fever
Aluminium (welding fumes) (as Al) CAS# 7429-90-5	1mg/m ³ (8-h TWA)	1mg/m ³ (8-h TWA)	Respiratory irritant; adverse effects in the lungs and central nervous system
Barium, soluble CAS# 7440-39-3	0.5mg/m ³ (8-h TWA)	0.5mg/m ³ (8-h TWA)	Eye, skin & GI irritant; muscular stimulant
Beryllium & compounds CAS# 7440-41-7	0.002mg/m ³ (8-h TWA)	0.0002mg/m ³ (8-h TWA) 0.0002mg/m ³ (STEL)	Metal fume fever; ¹¹ beryllium sensitisation; a carcinogen; other chronic effects include damage to the respiratory tract
Boron oxide CAS# 1303-86-2	10mg/m ³ (8-h TWA)	10mg/m ³ (8-h TWA)	Eye and respiratory irritant
Cadmium & compounds (as Cd) CAS# 7440-43-9	0.01mg/m ³ (8-h TWA)	0.001mg/m ³ (8-h TWA)	Irritation of respiratory system, sore and dry throat, chest pain and breathing difficulty; chronic effects include kidney damage and emphysema; suspected carcinogen
Chromium: - Chromium (II & III) - Chromium (VI)	0.5mg/m ³ (8-h TWA) 0.05mg/m ³ (8-h TWA)	0.05mg/m ³ (8-h TWA) Non-threshold genotoxic carcinogen – no WEL listed.	Increased risk of lung cancer; some individuals may develop skin irritation; some forms are known human carcinogens (Cr VI)
Cobalt, metal dust & fume (as Co) CAS# 7440-48-4	0.05mg/m ³ (8-h TWA)	0.02mg/m ³ (8-h TWA)	Irritant, fibrosis of the lung, sensitiser
Copper (fume) CAS# 7440-50-8	0.2mg/m ³ (8-h TWA)	0.2mg/m ³ (8-h TWA)	Acute effects include irritation of the eyes, nose and throat, nausea and metal fume fever
Fluorides (as F)	2.5mg/m ³ (8-h TWA)	2.5mg/m ³ (8-h TWA)	Acute effect is irritation of the eyes, nose and throat; long-term exposures may result in bone and joint problems; chronic effects also include excess fluid in the lungs

Iron oxide fume (Fe ₂ O ₃) (as Fe) CAS# 1309-37-1	5mg/m ³ (8-h TWA)	5mg/m ³ (8-h TWA)	Siderosis, a benign form of lung disease caused by particles deposited in the lungs; acute symptoms include irritation of the nose and lungs - tends to clear up when exposure stops
Lead, inorganic dusts & fumes (as Pb) CAS# 7439-92-1	0.05mg/m ³ (8-h TWA)	0.05mg/m ³ (8-h TWA)	Chronic effects to nervous system, kidneys, digestive system and mental capacity; can cause lead poisoning; ototoxic and therefore risk of hearing loss
Lithium hydride CAS# 7580-67-8	0.025mg/m ³ (8-h TWA)	0.02mg/m ³ (STEL)	Due to its caustic nature, the critical effect of exposure is irritation and damage to the eyes, respiratory tract, nasal mucosa and skin
Magnesium oxide (fume) CAS# 1309-48-4	10mg/m ³ (8-h TWA)	10mg/m ³ (8-h TWA)	Respiratory irritant, metal fume fever
Manganese, fume (as Mn) CAS# 7439-96-5	1mg/m ³ (8-h TWA) 3mg/m ³ (STEL)	0.1mg/m ³ (8-h TWA) (Inhalable fraction) 0.02mg/m ³ (8-h TWA) (Respirable fraction)	Metal fume fever; chronic effects may include central nervous system problems; ototoxic and therefore risk of hearing loss
Molybdenum CAS# 7439-98-7: - Molybdenum, insoluble compounds (as Mo) - Molybdenum, soluble compounds (as Mo)	10mg/m ³ (8-h TWA) 5mg/m ³ (8-h TWA)	10mg/m ³ (8-h TWA) (Inhalable fraction) 3mg/m ³ (8-h TWA) (Respirable fraction) 0.55mg/m ³ (8-h TWA)	Acute effects are eye, nose and throat irritation, and shortness of breath
Nickel CAS# 7440-02-0: - Nickel, soluble compounds (as Ni) - Nickel, metal	0.1mg/m ³ (8-h TWA) 1mg/m ³ (8-h TWA)	0.1mg/m ³ (8-h TWA) 0.1mg/m ³ (8-h TWA)	Acute effect is irritation of the eyes, nose and throat; increased cancer risk has been noted in occupations other than welding; also associated with dermatitis and lung problems
(Rosin core solder pyrolysis products (as formaldehyde))	0.1mg/m ³ (8-h TWA)	0.1mg/m ³ (8-h TWA)	Respiratory and/or skin irritant
Fumed silica (respirable dust) CAS# 7631-86-9	2mg/m ³ (8-h TWA)	2mg/m ³ (8-h TWA)	Fever, similar to metal fume fever
Tin, oxide & inorganic compounds, except SnH ₄ (as Sn) CAS# 7440-31-5	2mg/m ³ (8-h TWA)	2mg/m ³ (8-h TWA)	Stannosis, a rare benign form of lung disease caused by particles deposited in the lungs
Titanium dioxide CAS# 13463-67-7	10mg/m ³ (8-h TWA)	10mg/m ³ (8-h TWA)	Mild respiratory irritant

Vanadium (as V2O5), (respirable dust & fume) CAS# 1314-62-1	0.05mg/m ³ (8-h TWA)	0.05mg/m ³ (8-h TWA)	Acute effect is irritation of the eyes, skin and respiratory tract chronic effects include bronchitis, retinitis, fluid in the lungs and pneumonia
Zinc oxide (fume) CAS# 1314-13-2	5mg/m ³ (8-h TWA) 10mg/m ³ (STEL)	2mg/m ³ (8-h TWA) 10mg/m ³ (STEL)	Metal fume fever, bronchitis
Gasses			
Carbon monoxide CAS# 630-08-0	30ppm/34mg/m ³ (8-h TWA)	20ppm/23mg/m ³ (8-h TWA)	Absorbed readily into the bloodstream, causing headaches, dizziness or muscular weakness. High concentrations may result in unconsciousness and death. Ototoxic and therefore risk of hearing loss.
Hydrogen fluoride (as F) CAS# 7664-39-3	3ppm/2.6mg/m ³ (Peak)	0.5ppm/0.4mg/m ³ (Peak)	Irritating to the eyes and respiratory tract. Overexposure can cause lung, kidney, bone and liver damage. Chronic exposure can result in chronic irritation of the nose, throat and bronchi.
Nitrogen oxides: - Nitric oxide CAS# 10102-43-9 - Nitrogen dioxide CAS# 10102-44-0	25ppm/31mg/m ³ (8-h TWA) 3ppm/5.6mg/m ³ (8-h TWA) 5ppm/9.4mg/m ³ (STEL)	2ppm/2.5mg/m ³ (8-h TWA) 3ppm/5.6mg/m ³ (8-h TWA) 5ppm/9.4mg/m ³ (STEL)	Eye, nose and throat irritation in low concentrations. Abnormal fluid in the lung and other serious effects at higher concentrations. Chronic effects include lung problems such as emphysema.
Oxygen deficiency (Welding in confined spaces, and air displacement by shielding gas)	N/A	N/A	Dizziness, mental confusion, asphyxiation and death
Ozone CAS# 10028-15-6	0.1ppm/0.2mg/m ³ (Peak)	0.1ppm/0.2mg/m ³ (Peak)	Acute effects include fluid in the lungs. Very low concentrations (for example one part per million) cause headaches and dryness of the eyes. Chronic effects include significant changes in lung function.
Phosphine CAS# 7803-51-2	0.3ppm/0.42mg/m ³ (8-h TWA) 1ppm/1.4mg/m ³ (STEL)	0.05ppm/0.07mg/m ³ (8-h TWA) 0.15ppm/0.21mg/m ³ (STEL)	Irritant to eyes and respiratory system, can damage kidneys and other organs.
Organic vapours			
Aldehydes: - Acetaldehyde CAS# 75-07-0 - Formaldehyde CAS# 50-00-0	20ppm/36mg/m ³ (8-h TWA) 50ppm/91mg/m ³ (STEL) 1ppm/1.2mg/m ³ (8-h TWA) 2ppm/2.5mg/m ³ (STEL)	20ppm/36mg/m ³ (8-h TWA) 50ppm/91mg/m ³ (STEL) 1ppm/1.2mg/m ³ (8-h TWA) 2ppm/2.5mg/m ³ (STEL)	Irritant to eyes and respiratory tract

Isocyanates, all (as-NCO)	0.02mg/m ³ (8-h TWA) 0.07mg/m ³ (STEL)	0.02mg/m ³ (8-h TWA) 0.07mg/m ³ (STEL)	Eye, nose and throat irritation. High possibility of sensitisation, producing asthmatic or other allergic symptoms, even at very low exposures.
Phosgene CAS# 75-44-5	0.02ppm/0.08mg/m ³ (8-h TWA) 0.06ppm/0.25mg/m ³ (STEL)	0.1ppm/0.41mg/m ³ (8-h TWA) 0.4ppm/1.6mg/m ³ (STEL)	Severe irritant to eyes, nose and respiratory system. Symptoms may be delayed.