BREATHE FREELY IRELAND

Controlling exposures to prevent occupational lung disease in CONSTRUCTION

Steel Erector/Fabricator

HAZARDS AND RISKS

The biggest respiratory health risk to steel erectors/fabricators comes from inhaling welding fume. Numerous welding tasks are carried out on steel frames, columns, beams and girders that are used for assembling scaffolding, frameworks and other steel components of buildings and structures. There may also be a risk of disturbing asbestos in existing buildings. The WHO* and the ILO* estimate that approximately 400 people die annually in Ireland from occupational exposure to asbestos.

Welding fume

The fume given off by welding and hot cutting processes is a varying mixture of airborne gases and very fine particles that can cause a range of respiratory ill health effects if inhaled.

Stainless steel fume is considered more harmful than mild steel fume as it contains chromium oxide (CrO_3) (which can also form hexavalent chromium whilst welding) and nickel oxide, which are both asthmagens and carcinogens - although there is a higher risk of lung cancer for all welders. Flu-like symptoms of "metal fume fever" are caused by short-term exposure to high fume concentrations. Metal fume fever is a temporary effect. However, prolonged and repeated exposure to welding fume is associated with the neuro physiological and psychological effects of manganism (due to inhalation of manganese fume); respiratory irritation, bronchitis and possibly pulmonary oedema (due to inhalation of ozone and nitrous oxides); and Chronic Obstructive Pulmonary Disease (COPD) including emphysema.

Welders are known to be particularly susceptible to lung infections that can, in some cases, lead to pneumonia. Other health hazards include asphyxiation through using inert gases that reduce the amount of oxygen in enclosed spaces.

The WHO is the World Health Organisation, and the ILO is the International Labour Organisation. They are both United Nations agencies.

CONTROL OPTIONS

Elimination/prevention

- Design the job so there is less hot work, e.g. through CAD/3D design techniques, cold jointing techniques, use of mechanical fasteners and newer adhesive technologies; use thinner gauge material; use MIG brazing which produces less fume than a full penetration weld.

Engineering controls

- Control fume at source through local exhaust ventilation (LEV) or other engineering control equipment, or on-tool extraction if possible – LEV is unlikely to be feasible for outside work.
- Enclosed spaces may also need general mechanical ventilation to remove fume and ensure oxygen levels are maintained.
- Portable extraction units should be used where possible when on-gun extraction isn't available – especially when working indoors. It's important to make sure that the extraction inlet is positioned as close as possible to the welding point.
- Small bore high flow fume extractors can help remove fume when welding in tight corners.

Safe working methods

- Use MIG/MAG techniques for stainless steel welding (fume tends to be less toxic).
- Where protective coatings are present, these must be dressed back in order to provide a clean welding area.
- Minimise the amount of work carried out in enclosed or confined spaces.
- Make it easier for the welder to work with their head out of the fume cloud: a welder in a crouching position will be more likely to have fume passing their nose and mouth than if standing while they weld, and a seated welder will tend to have the least fume round their face.
- Ensure good general ventilation wherever possible.

PPE

- Powered Respiratory Protective Equipment (RPE), in conjunction with a welding visor and/or a purified air-powered helmet, should normally be worn in addition to other controls. There are various types available which offer different levels of protection. Particulate filter respirators do not remove gases such as oxides of nitrogen, and so are not suitable for this purpose.

MANAGING THE RISK

Training & communication

Supervision, maintenance and testing of controls and air monitoring are all vital aspects of managing the risk, in addition to health surveillance which can be a requirement in certain circumstances.

Air monitoring

Air monitoring is a specialist activity. It may be required as a result of a chemical agents risk assessment, as a periodic check on control effectiveness and to assess compliance with relevant Occupational Exposure Limit Values (OELVs), or where there has been a failure in a control (for example if a worker reports respiratory symptoms). A qualified occupational hygienist can ensure it is carried out in a way that provides meaningful and helpful results.

Refer to the current Health and Safety Authority's 'Code of Practice' for relevant OELVs.

Good control practice for welding fume

Frequency and duration of welding	Type of welding	Good control practice
Sporadic low- intensity welding	Gas, MMA, FCA, MIG, MAG	LEV where reasonably practicable. Otherwise good general ventilation and RPE
Regular and/or high-intensity welding	Gas, MMA, FCA, MIG, MAG	LEV and consider supplementary RPE
Regular and/or high-intensity welding outdoors in the open air	Gas, MMA, FCA, MIG, MAG, TIG	RPE where LEV is not reasonably practicable
Sporadic low-intensity welding	TIG and resistance spot welding	Good general ventilation
Regular and/or high-intensity welding	TIG and resistance spot welding	LEV

Definitions used in above table:

High-intensity welding: repeated welding throughout the shift. Welding arc time of more than 1 hour per welder per shift

Low-intensity welding: welding lasting less than 1 hour per welder per shift

Regular welding: daily or weekly welding **at any intensity**

The European Chemicals Agency (ECHA) is the body responsible for the administration of REACH in the EU It manages the submission of data in the form of dossiers from industry and provides guidance and assistance to industry through its website, guidance and helpdesk.

See reverse for Occupational Exposure Limit Values (OELs)

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OCCUPATIONAL EXPOSURE LIMITS (OELs) & EXPOSURE LEVELS

Agent or substance	Control/Exposure Limit	Exposure Levels
Welding fume	No Overall OELV	
Welding fume components:		The levels of exposure and subsequent risks to health vary depending on what type of welding process is undertaken, the base metal, the composition of the filler rod (core) and flux, any surface contaminants, the work environment (for example, whether indoors or outdoors, or in an enclosed space or an area that is well ventilated) as well as the exposure time (or 'arcing time').
Iron Oxide Fume (as Fe):	5 mg/m^3 (8-hr reference period) 10 mg/m^3 (15-min reference period)	
Chromium (VI) Compounds:	0.005 mg/m^3 (if process generated, e.g., fume from welding)	Chromium (VI) compounds are capable of causing occupational asthma and cancer.
Chromium (III) Compounds:	2 mg/m^3 (8-hr reference period)	There is no single welding fume exposure limit. As the composition of welding fume varies each of the constituents of welding fume would need to be identified and measured individually. The closest to a general welding fume OELV is the Iron Oxide OELV and the worst-case scenario (Chromium OELV) is applied when welding stainless steel. Occupational exposure limits for known welding fume constituents are under constant review. See Chemical Agents Code of Practice 2024. Chromium (VI) OELV is decreasing from 0.025 mg/m^3 to 0.005 mg/m^3 from 17th January 2025. Chromium (VI) compounds are capable of causing cancer and occupational asthma
Carbon monoxide:	20 ppm (8-hr reference period) 100 ppm (15-min reference period)	
Nitrogen monoxide:	2 ppm (8-hr reference period)	
Nitrogen dioxide:	0.5 ppm (8-hr reference period) 1 ppm (15-min reference period)	
Manganese and its inorganic compounds (as Mn):	0.2 mg/m^3 (8-hr reference period) inhalable fraction 0.02 mg/m^3 (8-hr reference period) respirable fraction	
Ozone	0.2 ppm to 0.05 ppm (heavy work)	
Asbestos (all types)	0.1 fibres/ml (8-hr reference period)	The aim should be to avoid any exposure. There is a high risk of exposure from particular ACMs, including sprayed asbestos coatings and asbestos insulation, which may be disturbed by workers when demolishing or renovating buildings built before 2000. An asbestos survey must be completed by a qualified independent asbestos consultant prior to any construction work taking place.

Further information

Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001 S.I. No. 619/2001, as amended 2015, 2021

Safety, Health and Welfare at Work (Carcinogens, Mutagens & Reprotoxic Substances) Regulations, 2024

Current Chemical Agents Code of Practice – Health and Safety Authority (hsa.ie)

Guidance for National Labour Inspectors on addressing health risks from Welding Fume

Guidelines on Occupational Asthma - Health and Safety Authority (hsa.ie)

A Guide to Respiratory Protective Equipment - Health and Safety Authority (hsa.ie)