

Welder

HAZARDS AND RISKS

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 (CrO₃) (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.

Exposure to tobacco smoke acts with welding fume to cause more damage to the lungs than would be the case with exposure to welding fume or smoking alone. Pneumococcal infections are more likely to occur for people who have low resistance to infections due to longstanding illnesses e.g. occupational lung disease.

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.
- Use automated or self-propelling weld profilers before parts are formed or have parts added that prevent their use; buy in raw materials with edge profiles already cut; make use of ceramic backing tiles and inert gas backing techniques; ensure surface coatings are removed prior to welding.
- Use a welding technique that makes less fume: use correct sized torch (avoid using a bigger torch than is needed); use short flames; avoid free-burning flames; minimise the distance between torch and work piece; for arc welding use the lowest current and voltage applicable, and lower cutting speed.

Engineering controls

- Control fume at source through local exhaust ventilation (LEV) or other engineering control equipment, or on-tool extraction where possible – containment/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.
- Use of turntables can enable welding in a position where fume rises away from the face.

Working methods

- 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.

PPE

- Powered respirators, 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.

Health protection

- Employers should consider offering the PPV23 (pneumococcal polysaccharide) vaccination. This vaccine is recommended for welders to protect against infectious diseases.

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**

Welder

OCCUPATIONAL EXPOSURE LIMIT VALUES (OELVs) AND EXPOSURE LIMITS

| Agent or substance | Control/Exposure Limit | Exposure Levels |
|---|--|---|
| Welding fume components: | | |
| Iron Oxide Fume (as Fe): | 5 mg/m ³ (8-hr reference period) 10 mg/m ³ (15-min reference period) | <p>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').</p> <p>Chromium (VI) OELV is decreasing from 0.025 mg/m³ to 0.005 mg/m³ from 17th January 2025. Chromium (VI) compounds are capable of causing cancer and occupational asthma</p> <p>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.</p> |
| Chromium (VI) Compounds: | 0.005 mg/m ³ (if process generated, e.g., fume from welding) | |
| Chromium (III) Compounds: | 2 mg/m ³ (8-hr reference period) | |
| 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) | |

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 \(hsa.ie\)](#)