

Health surveillance for welding fume exposure – guide for doctors



Background

Welding and other hot work processes can generate fumes that include a complex mixture of airborne particles and gases, which can pose significant health risks to workers. In the Queensland coal industry, welding and other hot work processes typically occur during repairs and maintenance of heavy mobile plant and fixed structures, often in situ. They may also be conducted in workshops, confined spaces during plant shutdowns, or underground, though this is less common.

Resources Safety and Health Queensland (RSHQ) has published [Guidance Note 36: Managing exposure to welding fume in coal mines](#) (QGN 36)¹. QGN 36 provides practical guidance for managing welding fume hazards in coal mining operations, including health risks, exposure monitoring, effective control measures and health surveillance. This guidance also applies to other hot work processes.

The purpose of this guide is to provide information to assist appointed medical advisers (AMA) and examining medical officers (EMO), who perform health surveillance under the Coal Mine Workers' Health Scheme (the Scheme), to carry out health surveillance for workers exposed to welding fume.

Exposure risk

Welding involves joining metal components using intense heat, often with consumable electrodes or filler materials. Welding fumes are generated during this process and primarily come from the base metals, electrode materials, and any surface contaminants or coatings on the metal being welded (Safe Work Australia, 2025).

Welding fumes consist of airborne particulates, ranging in size from 0.01 to 1 micrometre (μm), with inhalation being the primary exposure route (Australian Institute of Occupational Hygienists, 2022). Other hot work processes, such as brazing, soldering, cutting, grinding and gouging, also generate fumes.

In addition to particulates, gases such as oxides of nitrogen (NO_x), carbon oxides, and ozone (O_3) are formed during certain types of welding, for example arc welding.

Most welding tasks performed on coal mining sites involve mild steel, which commonly contains manganese. Welding with stainless steel, aluminium and galvanised metal components is relatively uncommon.

¹ Queensland Guidance Notes can be found: <https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards/recognised-standards>

Health effects

Inhalation of welding fumes and gases is associated with a range of short- and long-term health effects, including:

- irritation of the upper respiratory tract
- asphyxiation
- metal fume fever
- pneumonia
- asthma
- bronchitis
- emphysema
- chronic obstructive pulmonary disease (COPD)
- siderosis
- cancer.

Studies indicate welders have a 30 to 40% higher risk of developing lung cancer compared to the general population and there is a probable association with kidney cancer (Honaryar, et al., 2019; Safe Work Australia, n.d.-a).

Exposure to specific metals or compounds in welding fumes may also cause additional health effects. For example, exposures to welding fume containing lead or manganese may lead to neurological effects, whilst exposures to welding fume containing nickel and chromium, can result in skin irritation or allergic contact dermatitis.

Metals found within some welding fumes, including lead and manganese, are also known to be ototoxic. Ototoxic substances may damage the cochlea and/or auditory nerve pathways to the brain, leading to hearing loss and tinnitus. The combined effects of exposure to welding fume and noise can have a synergistic effect, leading to higher levels of hearing impairment.

Chronic exposure to ozone, for example during arc processes, may contribute to occupational asthma and may also exacerbate existing respiratory conditions including COPD.

Safe Work Australia's *Welding processes Code of Practice* (2022) includes a comprehensive list of fume, gas and vapour types and their health effects.

Health surveillance requirements

The site senior executive (SSE) and employers have obligations for ensuring health surveillance is completed for coal mine workers identified as being at risk of exposure to welding fumes.

Health surveillance aims to:

- monitor for changes to a worker's health from baseline at the earliest opportunity
- enable early intervention to protect workers' health
- ensure that exposure controls and monitoring programs are effective.

Health surveillance is to be carried out by, or under the supervision of, an AMA under the Scheme.

Identifying workers at risk of welding fume exposure

Employers are required to identify in the employer section of the health assessment form on ResHealth that welding fumes is one of the hazards to which the worker may be exposed.

Doctors must review each worker's hazard exposures in ResHealth to identify workers that must undergo welding fume health surveillance.

Timing for health surveillance

For workers identified as at risk of welding fume exposure, health surveillance should be completed:

- before a worker commences work that may involve exposure to welding fume
- at frequencies specified under the Scheme, or as advised by the AMA.

and with consideration of the following:

- any personal exposure monitoring results
- specific welding fume tasks/exposures
- duration, frequency and level of exposure for workers
- effectiveness of engineering controls
- respiratory protection use (type and frequency of use).

If workers change employers, previous health surveillance results may be relied upon, if in-date and the new AMA considers it appropriate.

Carrying out health surveillance

Health surveillance for welding fume must include the following components completed in accordance with the Scheme requirements:

- collection of worker demographic information and medical history
- occupational history including specific welding fume tasks/exposures
- clinical examination including cardiovascular system, audiometry, skin and respiratory system
- respiratory questionnaire including smoking history
- spirometry
- comparison with earlier health surveillance results to identify longitudinal decline and the development of occupational diseases, such as occupational asthma or work-related dermatitis
- follow-up tests or reviews to investigate any symptoms, abnormalities or to monitor change to ensure early detection of adverse health effects related to welding fume exposure.

When reviewing occupational and medical history, AMAs should review the workers' previous exposure to welding fumes or similar hazards. This should include consideration of duration, frequency and level of historical exposure, or if the worker is new to welding. AMAs should also assess the presence of any symptoms, such as cough, wheeze, dermatitis or signs of sensitisation. These may indicate the development of an occupational disease, including occupational asthma or allergic contact dermatitis.

Certain pre-existing conditions may increase a worker's susceptibility to adverse effects from welding fume exposure. These include:

- skin sensitisation (allergic dermatitis)
- respiratory sensitisation, including asthma and allergic rhinitis
- chronic obstructive pulmonary disease (COPD)
- silicosis
- pneumoconiosis
- other occupational lung diseases
- impaired lung function.

Safe Work Australia health monitoring guides may also assist AMAs when considering tailored requirements where exposure risk profiles identify specific types of hazardous welding fume components. Depending on the type of welding fume exposures, the AMA may determine that additional medical examinations or tests are required to detect potential adverse health effects. For example, exposure to manganese-containing welding fumes can result in chronic effects on the central nervous system. In such cases, AMAs may consider conducting neurological assessments, including evaluation of:

- posture and gait
- muscular tone and coordination
- speech
- tremor.

AMAs may also consider personal exposure monitoring results to support the health surveillance process. The SSE and employer should facilitate the reporting of welding fume exposure monitoring results when requested by the AMA. If relevant for specific hazardous welding fume exposures, the AMA may also consider biological monitoring (e.g. analysis of breath, urine or blood samples).

Completing the health assessment

AMAs must consider the findings of health surveillance when determining a worker's fitness for work, taking into account:

- results that indicate the worker may have contracted an occupational disease or has symptoms as a result of exposure to welding fume
- the worker's ability to use required RPE (e.g. powered air purifying respirator (PAPR), negative pressure disposable P2 mask)²
- any recommendations for remedial measures, including review of workplace controls to ensure an acceptable level of risk for the worker.

The AMA shall also determine requirements for any subsequent assessments for welding fume health surveillance at relevant intervals, considering the results of the health surveillance, individual occupational and medical history and exposure risks.

Where relevant, the AMA will discuss with the worker to seek further advice regarding the treatment or management of a medical condition from their treating medical practitioner.

² Refer to RSHQ's Respiratory protective equipment at work – a practical guide: <https://www.rshq.qld.gov.au/occupational-health/physical-health/respiratory-health/prevention>

Other considerations

Pneumococcal vaccination

Occupational exposure to welding fume is associated with an increased risk of pneumococcal disease, including invasive disease and pneumonia. For individuals with increased susceptibility, vaccination may be appropriate.

Although not required under the Scheme, AMAs may consider discussing with employers and workers the option of offering a single dose of pneumococcal vaccine (preferably a conjugate vaccine) for:

- workers aged 50 years or older who undertake welding or are routinely exposed to metal fume
- workers of any age with identified risk factors (e.g. smoking, COPD, diabetes).

Vaccination should be voluntary and decided in consultation between the AMA and the worker.

Consultation draft

References

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