Welding Fume Hazards & Controls

Welding creates strong metal joints, but it also produces **fumes and gases** that can seriously harm your health. Unlike burns or eye injuries, the effects of welding fumes often **don't show up right away**, which makes them easy to underestimate.

What Are Welding Fumes?

When metal is heated above its boiling point, it **vaporizes**. As this vapor cools, it turns into **tiny solid particles** called welding fumes. These particles mainly come from:

The **base metal** being welded, the **electrode or filler metal**, **fluxes, coatings, paints, oils, and residues.**

The visible fume cloud often contains metals, metal oxides, silicates, and fluorides.

Health Effects of Welding Fume

Short-term exposure can cause: Nausea, dizziness, headaches, Irritation of the eyes, nose, and throat, Metal fume fever (flu-like symptoms)

Long-term or repeated exposure can lead to: Lung cancer, larynx cancer, urinary tract cancer, Chronic lung problems, Nervous system and kidney damage.

Some specific hazards include:

- **Beryllium, cadmium, chromium, nickel, manganese** – Can cause cancer, lung damage, neurological issues, and skin problems.
- **Iron oxides** – Can cause siderosis (iron deposits in the lungs).
- **Hexavalent chromium** (from stainless and chromium steels) – A known human carcinogen; very toxic to eyes, skin, nose, throat, and lungs.

Welding can also generate dangerous **gases**, such as:

- **Carbon monoxide** – Headaches, dizziness, unconsciousness, death at high levels
- **Ozone, nitrogen oxides, hydrogen fluoride, phosgene** – Serious lung and respiratory damage
- **Argon, CO_2, helium** – Can **displace oxygen** and cause suffocation in confined or poorly ventilated areas.

How to Reduce Exposure

1. Know the hazards

- Read and follow **Safety Data Sheets (SDS)** and manufacturer's instructions for base metals, electrodes, and coatings.
- Understand what you're welding and what it can produce when heated.

2. Use ventilation and fume extraction

- Use **local exhaust ventilation (LEV)** or fume extraction at the arc to pull fumes away from your breathing zone.
- Make sure the work area has **good general ventilation** to prevent buildup of fumes, gases, and oxygen displacement.
- Aim exhaust **away from other workers** and, when possible, **vent outdoors**.

3. Choose safer options when possible

- Look for **consumables and processes that generate less fumes** or contain fewer toxic metals.

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- When practical, select welding methods that naturally produce lower fume levels.

4. Work practices

- Keep your head **out of the fume plume**—position yourself so fumes move away from your face.
- Avoid welding in **confined spaces** without proper ventilation, permits, and monitoring.
- Take breaks in cleaner air to reduce overall exposure.

5. Clean the metal first

- Remove paints, primers, oils, rust inhibitors, and other coatings whenever possible.
- The cleaner the surface, the **less toxic** the fumes.

6. Respiratory protection

- Use **appropriate respirators** when ventilation alone cannot keep exposure within safe limits.
- Remember: respirators **do not replace** engineering controls and ventilation; they are a backup, not the primary solution.