

Welding Fumes and Gases Table

FUMES	SOURCES	EFFECTS and SYMPTOMS
Aluminum	Aluminum component of some alloys, e.g. Inconels, copper, zinc, steel, magnesium, brass and filler materials.	Respiratory irritant
Beryllium	Hardening agent found in copper magnesium aluminum alloys and electrical contacts.	“Metal fume fever.” A carcinogen. Other chronic effects include damage to the respiratory tract
Cadmium Oxides	Stainless steel containing cadmium or plated materials, zinc alloy	Irritation of Respiratory system, sore and dry throat, chest pain and Breathing difficulty. Chronic effects include kidney damage and Emphysema. Suspected Carcinogen
Chromium	Most Stainless-steel and high-alloy materials, welding rods. Also used as a plating material.	Increased risk of lung cancer. Some individuals may develop skin Irritation. Some forms are carcinogens (hexavalent chromium).
Copper	Alloys such as Monel, brass, bronze. Also some welding rods.	Acute effects include irritation of the eyes, nose, and throat, nausea and Metal Fume Fever
Fluorides	Common electrode coating and flux material for both low-and high-alloy steels	Acute effect is irritation of the eyes, nose and throat. Long term exposures may result in bone and joint problems. Chronic effects include excess fluid in the lungs.
Iron Oxide	The major contaminant in all iron or steel welding	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 exposures stop.
Lead	Solder , brass and bronze alloy's, primer/ coating on steel	Chronic effects to nervous system, kidneys, digestive system and mental capacity. Can cause lead poisoning

Manganese	Most welding processes especially high tensile steels	Acute effects include Metal Fume Fever. Chronic effects may include central nervous system problems.
Molybdenum	Steel alloys, iron, stainless steel, nickel alloys	Acute effects are eye, nose and throat irritation, and shortness of breath.
Nickel	Stainless Steel, Inconel, Monel, Hastelloy, and other high alloy materials, welding rods and plated steel.	Acute effect is eye, nose and throat irritation. Increased cancer risk has been noted in occupations other than welding. Also associated with dermatitis and lung problems.
Vanadium	Some steel alloys, iron stainless steel and nickel alloys	Acute effects are eye and skin irritation and respiratory tract irritation. Chronic effects include bronchitis, retinitis, fluid in the lungs and pneumonia.
Zinc Oxides	Galvanized and painted Metal.	Metal Fume Fever

Gases	Sources	Effects and Symptoms
Carbon Monoxide	Formed in the arc	Absorbed readily into the bloodstream, causing headaches, dizziness or muscular weakness. High concentrations may result in unconsciousness or death.
Hydrogen Fluoride	Decomposition of rod coatings.	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 Oxide	Formed in the arc.	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 shield gases.	Dizziness, mental confusion, asphyxiation and death.
Ozone	Formed in the welding arc, especially during plasma-arc, MIG and TIG processes	Acute effects include fluid in the lungs and hemorrhaging. Very low concentrations, (one part per million) cause headaches and dryness of the eyes. Chronic effects include significant changes in lung function

Organic Vapors	Sources	Effects and symptoms
Aldehydes (formaldehyde)	Metal coating with binders and pigments. Degreasing solvents	Irritant to eyes and respiratory tract
DI-isocyanates	Metal with polyurethane paint	Eye, nose and throat irritation. High possibility of sensitization, producing asthmatic or other allergic symptoms, even at very low exposures.
Phosgene	Metal with residual degreasing solvents. (Phosgene is formed by reaction of the solvent to welding radiation.)	Severe irritant to eyes, nose, and respiratory system. Symptoms may be delayed.
Phosphine	Metal coated with rust inhibitors. (Phosphine is formed by the reaction of the rust inhibitor and welding radiation)	Irritant to eyes and respiratory system, can damage kidneys and other organs.

(A Welders Guide to the Hazards of Welding Gases and Fumes. (2004))