Welders’ Safety and Health Guide

Introduction
Welding often involves a variety of physical and chemical hazards. These hazards are varied and dependant on the type of welding process, and the quantity and type of materials used. These hazards include specific base and filler metals, fluxes, shielding gases and primers.

Safety Guidelines
Protect workers from welding fumes and gases. Exhaust ventilation may be necessary, especially when welding with particularly hazardous materials, large volumes of materials, or when welding for long periods of time. Proper ventilation is essential in enclosed or confined spaces. Welding tables equipped with slot exhausts, portable welding exhaust ventilation systems including moveable elephant trunk exhaust, and small diameter welding gun mounted fume extractors are commercially available. Air-purifying respirators can filter out metal fumes, they do not protect workers from all of the hazardous gases produced or oxygen deficiency.

Proper cleaning and removal of primers, paints, cleaners and surface coatings from welding surfaces will reduce exposures.

Consider orientation of materials and body position of the welder when laying out the job and conducting the work, allowing the welder to avoid the natural heat rise of the fumes when possible. Exposures can be significantly reduced if welders are not positioned directly over fumes.

Only operate welding equipment you have been trained to use. Know what the substance is that is being welded and any coating on it.

Make sure a fire extinguisher is near for immediate use. Check area before welding to be sure no flammable material or degreasing solvents are near the welding area.

Wear protective clothing to cover all exposed areas of the body (closely woven clothing, long socks, gloves), leak proof welder’s helmet. If goggles are worn, be sure the tint is corrected to protect from ultraviolet and infrared radiation.

If others are working in the area, be sure they are warned of and protected against arc, fumes, sparks, and other welding hazards.

Use spark catchers when working at elevated levels.

Always make sure there is good local exhaust ventilation. Always avoid inhaling fumes of any kind. A NIOSH approved respirator and local exhaust ventilation should be used in all confined areas.

Deposit all scraps and electrode butts in proper waste container to avoid fire and toxic fumes.

Check welding area when job is completed to be sure there are no smoldering materials, hot slag, or live sparks.

Closed containers that have held flammables or combustibles must be properly cleaned or purged before work is started.

Use a fire watchman when welding or cutting on walls, bulkheads, and through doors or other similar situations where you cannot see dangers ahead. First be certain there are no flammable solids, liquids, gases, or vapors behind the bulkhead on which you weld.

Check area for degreasing equipment. No welding should be done within 200 feet of degreasing solvents because deadly phosgene gas is produced by welding near degreasing solvents.

Electric Arc
Be sure electrode is clear of the conductor before starting work.
Be sure all connections or leads are in place; leads should be installed.
Keep yourself insulated from ground or metal when changing electrodes.
Shut off machine when leaving work; disconnect at the power source.
Never look at a flash even for an instant. Be sure to turn your head completely away from the arc and be careful of reflections. Your eyes can be severely damaged by the infrared rays.

Acetylene
Oxygen under pressure reacts violently.
If there is a leak in an oxygen or gas cylinder take it outside and slowly release gas.
Close the cylinder valve as soon as work is finished, or when taking a break for any period of time.
When cylinders are emptied, close the valve, replace the protective cap and mark the cylinder "MT."

The valve on the acetylene cylinder should never be opened more than one and one-half turns.

Make sure gas systems have check valves to prevent back flow into the fittings and that couplings are secure.

### High Voltage

#### Electrodes

**Source:** Live electrode  
**Effect:** Burns, shocks, electrocution  
**Control:** Cover electrodes, keep splices in safe condition; no welding in wet conditions

#### Fumes

**Control:** Local exhaust ventilation; wear an approved NIOSH respirator if in confined area. See a physician if overexposure to welding fumes is suspected

#### Antimony

**Source:** Antimony-lead solder  
**Effect:** Irritates skin and eyes; headache and vomiting

#### Brass

**Source:** Welding; lead and copper alloy  
**Effect:** Dermatitis; metal fume fever; see also copper and lead effects

#### Cadmium

**Source:** Paint, some silver solders, filler materials for welding  
**Effect:** Irritates skin and mucous membranes; gastroenteritis (stomach pain), lung irritation, chest pain, bronchitis, fluid in lungs, chills with fever

#### Chromium

**Source:** Adhesives, cement, paint, metal coating, stainless steels  
**Effect:** Bronchitis, skin ulcers, nose, and nasal passage irritant

#### Copper

**Source:** Cutting, soldering of copper pipe  
**Effect:** Irritates nose and throat; metal fume fever

#### Cobalt

**Source:** Welding fumes and grinding dusts  
**Effect:** Irritates skin; can damage lungs, heart, liver, kidney; metal fume fever

#### Iron

**Source:** Welding on iron or steel, scraping iron or steel  
**Effect:** Metal fume fever

#### Lead

**Source:** Pipe joints, paints, demolition, remodeling  
**Effect:** Abdominal pain, headache, muscular aches, weakness, central nervous system and kidney damage, anemia, effects on bone marrow; metal fume fever, impotency

#### Magnesium

**Source:** Welding fumes and grinding dust  
**Effect:** Metal fume fever

#### Manganese

**Source:** Welding electrodes  
**Effect:** Increased levels of manganese in blood and urine; chronic manganese poisoning; headache, apathy, sexual impotence, speech disturbances, slowed reflexes, effects on central nervous system

#### Nickel

**Source:** Welding fumes and grinding dust  
**Effect:** Human carcinogen, nickel allergy dermatitis

#### Tin

**Source:** Welding fumes and grinding dust  
**Effect:** Metal fume fever

#### Zinc

**Source:** Soldering or welding zinc coated or galvanized metal; paint pigment  
**Effect:** Irritation of respiratory tract, dryness of throat, dry coughs, malaise, headache, nausea, severe chills with fever, pains in limbs, shaking in limbs, sweating, metal fume fever

#### Vapors

**Source:** Degreaser solvents; ultraviolet rays in welding can decompose degreasing solvents forming highly toxic gases  
**Effect:** Phosgene is a highly toxic gas which can cause death. Initial effects are irritation to skin, eyes, nose, throat, and chest; dizziness and chills. Delayed effects: 2 to 24 hours after exposure, outpouring of fluid into air sacs of lungs. Can be fatal  
**Control:** Good ventilation; protective clothing; do not weld near degreasing operations as toxic gases can be formed when degreasing solvents are exposed to strong ultraviolet light from welding
Gases

**NOTE:** When welding in any confined area a respirator should always be used.

**Acetylene**
- **Source:** Gas used in oxyacetylene welding
- **Effect:** Rapid breathing, loss of coordination; high concentration can cause suffocation
- **Control:** Good local exhaust ventilation

**Arsine**
- **Source:** Possible contamination of commercial acetylene
- **Effect:** Anemia (breakdown of red blood cells), jaundice, pulmonary edema, irritates eyes, nose, skin, lungs
- **Control:** Good local exhaust ventilation

**Carbon Dioxide**
- **Source:** Welding by product
- **Effect:** Headache, dizziness, nausea, vomiting; in high concentrations symptoms of suffocation, eventual unconsciousness and eventual suffocation
- **Control:** Good local exhaust ventilation

**Carbonic Acid**
- **Source:** In a damp atmosphere carbon dioxide combines with water vapor
- **Effect:** Irritates eyes, skin and mucous membranes
- **Control:** Good general ventilation and dry work conditions

**Nitrogen Dioxide**
- **Source:** Welding by product
- **Effect:** Irritates nose, throat, lungs; causes headache, chest pain, drowsiness, hemorrhage, fluid in lungs, lung damage
- **Control:** Good general ventilation (if air smells sweet like electrical storm, stop work immediately and get fresh air)

**Ozone**
- **Source:** Welding by product
- **Effect:** Irritates nose, throat and eyes; coughing, chest pain, headache, shortness of breath, pulmonary edema
- **Control:** Good general ventilation of welding area (if air smells sweet like electrical storm, stop work immediately and get fresh air)

**Phosgene**
- **Source:** Welding by product; produced when ultraviolet rays given off by welding decompose degreasing chemicals
- **Effects:** Highly toxic, can cause death. Initial effects are irritation to skin, eyes, nose, throat and chest; dizziness, chills, thirst; delayed effects: 2 to 24 hours after exposure the outpouring of fluid into air sacs of lungs can be fatal
- **Control:** No welding should be done within 200 feet of degreasing operations; if gas is smelled, evacuate area immediately

**Phosphine**
- **Source:** Possible contaminant of commercial acetylene
- **Effects:** Fatigue, tremors, coma, convulsions, pulmonary edema; long term exposure can cause anemia and stomach problems
- **Control:** Good local exhaust ventilation

**Radiation, Non-Ionizing**

**Ultraviolet**
- **Source:** Arc or its reflection
- **Effect:** Irritates and damages eye tissue; can cause painful sunburn and possibly skin cancer
- **Control:** Proper eye protection; clothing covering all parts of the body; separate welders from all other workers

**Infrared**
- **Source:** Heat waves given off by all bodies that radiate heat
- **Effect:** Can cause damage to parts of the eye; workers may develop a condition called “heat cataract”
- **Control:** Regular clothing; goggles to protect eyes

**Metallic Sparks/Molten Metal**

**Sparks**
- **Source:** Heated metal, hot metal
- **Effect:** Burns, fires
- **Control:** Eye protection; protective clothing including long pants, sleeves, and socks; gloves
<table>
<thead>
<tr>
<th>Type Of Welding</th>
<th>Hazard</th>
<th>Source</th>
<th>Material</th>
<th>Effect</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arc Acetylene</td>
<td>Fumes</td>
<td>Metal being welded; electrode used; coating on metal; flux; filler metals</td>
<td>Cadmium, cobalt, lead, antimony, chromium, copper, iron, beryllium, magnesium, manganese, tin, zinc, fluorides</td>
<td>Metal fume fever, irritation to lungs, throat and coughing, nausea, headache, chills with fever, aching in joints, loss of appetite</td>
<td>Local exhaust ventilation; respirator if in confined area</td>
</tr>
<tr>
<td>Arc especially inert gas weld</td>
<td>Non-ionizing radiation</td>
<td>Welding arc</td>
<td>Infrared and ultraviolet</td>
<td>Irritates and damages eye tissue; can cause painful sunburn and possibly skin cancer</td>
<td>Tinted glass to shield welder; proper eye protection and body covering including all exposed skin; separate welders from other workers; welding screens</td>
</tr>
<tr>
<td>Arc Acetylene</td>
<td>Toxic gases</td>
<td>The arc, burning process or changes in the atmosphere</td>
<td>Acetylene, arsenic, carbon, dioxide, carbonic acid, carbon monoxide, nitrogen dioxide, ozone, phosgene, phosphine</td>
<td>Some symptoms—headache; nausea; irritates lungs; eyes, nose and skin; dizziness and lack of appetite</td>
<td>Respirator if in confined area; good local exhaust ventilation</td>
</tr>
<tr>
<td>Arc Acetylene</td>
<td>Metallic sparks molten metal</td>
<td>Sparks from heated metal; hot metal</td>
<td>All metals</td>
<td>Burns, fires</td>
<td>Eye protection; clothing-pants, long sleeves and socks; gloves</td>
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<tr>
<td>Arc</td>
<td>High voltage</td>
<td>Splices, wires</td>
<td></td>
<td>Shocks, fires</td>
<td>Keep electrodes covered, keep all electric cable splices and wires in good condition, avoid welding in damp area</td>
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<tr>
<td>Arc</td>
<td>Solvent vapors</td>
<td>Cleaning and degreasing of metals before welding; ultraviolet rays in welding decompose degreasing solvents</td>
<td>Trichloroethylene and other chlorinated hydrocarbons; degreasing solvents can produce deadly phosgene gas on exposure to ultraviolet rays of arc</td>
<td>Can be fatal; irritates skin, eyes, nose, throat and chest; dizziness; chills, thirst; delayed effect; fluid in lungs and death</td>
<td>No welding within 200ft. of degreasing operations; if gas smell, welding should be stopped immediately and area evacuated</td>
</tr>
</tbody>
</table>

The foregoing is not intended to be a substitute for professional medical advice, diagnosis, or treatment. Always seek the advice of a physician or other qualified health provider with any questions you may have regarding a medical condition. If you think you may have a medical emergency, call your doctor or 911 immediately.

This product was developed for you by State Fund, your partner in loss prevention. We recognize that your loss prevention efforts can affect the frequency and severity of illnesses and injuries in your work environment. Our experience shows that with informed planning and education, workplace injuries and illnesses can be reduced or eliminated. We are committed to the belief that a safe workplace can increase worker productivity and lower your workers' compensation costs. The safety and well-being of our insured employers and their employees is the primary concern of State Fund. We know you will find this information helpful in educating and encouraging your employees to establish and maintain a safe working environment.