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HEALTH HAZARDS IN WELDING

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PFI Health Hazards in Welding Best Practice

Welding is a method for joining pieces of metal using heat, pressure, or both. Some of the most common types of welding include arc welding, which includes “stick” or shielded metal arc welding (SMAW); the gas-shielded methods of metal inert gas (MIG) and tungsten inert gas (TIG); plasma arc welding (PAW); and submerged arc welding (SAW). Other welding processes may use oxyacetylene gas, electrical current, lasers, electron beams, friction, ultrasonic sound, chemical reactions, heat from fuel gas.

The health effects of welding exposures vary widely because the fumes may contain different substances that are known to be harmful. The individual components of welding smoke can affect many body parts, including lungs, heart, kidneys, and the central nervous system. Welders who smoke may be at greater risk health impairment than welders who do not. Exposure to welding fumes may have short and long-term health effects.

This best practice is intended to maintain a safe workplace for employees; therefore, it cannot be overemphasized that only trained and qualified individuals shall perform welding procedures. The guidance within these practices applies to welding processes and the individuals that perform and supervise these processes. All employees performing, or whom are exposed to, welding processes should be made aware of the materials, chemicals, processes and associated hazards and controls prior to beginning operations. As part of this practice a company should ensure all Safety Data Sheets (SDS's) are available and accessible to all employees. SDS's shall be maintained for all products and materials in a shop environment.

Short-Term Health Effects

Exposure to metal fumes (such as zinc, magnesium, copper, and copper oxide) can cause metal fume fever. Symptoms of metal fume fever may occur four to 12 hours after exposure and include chills, thirst, fever, muscle ache, chest soreness, coughing, wheezing, fatigue, nausea, and a metallic taste in the mouth.

Welding smoke can also irritate the eyes, nose, chest, and respiratory tract, and cause coughing, wheezing, shortness of breath, bronchitis, pulmonary edema (fluid in the lungs), and pneumonitis (inflammation of the lungs). Gastrointestinal effects, such as nausea, loss of appetite, vomiting, cramps, and slow digestion, have also been associated with welding.

Some components of welding fumes, such as cadmium, can be fatal in a short time. Secondary gases given off by the welding process can also be extremely dangerous. For example, ultraviolet radiation given off by welding reacts with oxygen and nitrogen in the air to form ozone and nitrogen oxides. These gases are deadly at high doses and can cause irritation of the nose and throat and serious lung disease.

Long Term Health Effects

Studies have shown that welders have an increased potential risk of lung cancer, and possibly cancer of the larynx (voice box) and urinary tract. Welders may also experience a variety of chronic respiratory problems, including bronchitis, asthma, pneumonia, emphysema, pneumoconiosis referring to dust-related diseases, decreased lung capacity, silicosis caused by silica exposure, and siderosis, a dust-related disease caused by iron oxide dust in the lungs. Other health problems that appear to be related to welding include: heart disease, skin diseases, hearing loss, chronic gastritis (inflammation of the stomach), gastroduodenitis (inflammation of the stomach and small intestine), and ulcers of the stomach and small intestine. Welders exposed to heavy metals, such as chromium and nickel, have also experienced kidney damage.

Welding can also potentially pose reproductive risks to welders. Studies have shown that welding has had adverse effects on sperm quality, conception, and pregnancies among welders or their spouses. Possible causes include exposure to metals, such as aluminum, chromium, nickel, cadmium, iron, manganese, and copper; gases, such as nitrous gases and ozone; heat; and ionizing radiation used to check the welding seams.

Engineering Controls and Work Practices

Ventilation should be used to remove harmful fumes and gases. Local exhaust ventilation, which removes the fumes and gases at their source, is the most effective method. This can be provided by a partial enclosure, such as a ventilated workbench, or by hoods positioned as close to the point of welding as possible. Ventilation systems should be cleaned and maintained regularly.

General ventilation uses roof vents, open doors and windows, roof fans, or floor fans to move air through the entire work area. This is not as effective as local exhaust ventilation and may simply spread chemicals around the workplace. General ventilation is often helpful, however, when used to supplement local ventilation.

Use welding screens to protect other people in the work area from the light of the welding arc, heat, and hot spatter.

Modify the process or follow safe work practices so that hazards are eliminated:

- Do not weld painted or coated parts. If possible, remove all surface coatings before welding.
- Grind parts instead of air arcing.
- Position yourself while welding or cutting so that your head is not in the path of smoke/fumes.
- Remove all nearby flammable or combustible materials before striking an arc or lighting a flame.
- Make sure that equipment is properly maintained.
- Welding areas should be kept free of equipment and machines that could cause trips or falls.
- You can minimize the production of welding fumes by using the lowest acceptable amperage and holding the electrode perpendicular and as close to the work surface as possible.
- Inspect equipment for damage prior to use (repair any damaged equipment prior to use) and only use as directed by the manufacturer.
- Always ensure that material is properly grounded
- Never touch the electrode or metal parts of the electrode holder with skin or wet clothing. Keep dry insulation between the body and the metal being welded or ground (such as a metal floor or wet surfaces).

Personal Protective Equipment

PPE should always be used along with engineering controls and safe work practices.

Eye protection should be used for all welding operations to protect the eyes from bright light, heat, ultraviolet light, and flying sparks. For the best protection, wear welding hoods with appropriately shaded lenses and safety glasses. It is also important to note that welding hoods eliminate peripheral vision. So, it is important for a welder to evaluate his/her surroundings every time they lift their hood or take a break from the welding operation.

Protective clothing should be made of wool or specially treated cotton fabrics. Sleeves and collars should be kept buttoned, and pants and shirts should be uncuffed.

Hearing protectors such as ear plugs or ear muffs should be used during operations in excess of 85 dBA as a time weighted average.

Respirators must be specific to the hazard and be fitted, cleaned, stored, and maintained in accordance with OSHA's respirator standard. In addition, workers must receive training in how to use respirators properly. Employees shall be medically cleared and fit tested to wear the type of respirator required by the work type.

Industrial Hygiene (IH) Testing and monitoring recommendations

Routine industrial hygiene monitoring should be conducted to determine the levels of hazardous materials in the welding area.

IH Monitoring shall be based on the following:

- Job Location
- Welding Process and Time spent welding
- Type of Base metal and Type of Wire
- Amount of Wire used per shift
- Ventilation Conditions

All industrial hygiene monitoring results shall be shared with any effected employee performing welding or working in the area where the monitoring was performed. In addition, monitoring done for a specific worker must be kept for employment. Where applicable there may also be a requirement to keep such information for employment plus 30 years.

Additional Resources

Offer safety guidelines to help control, minimize or to help employers and employees avoid and control welding hazards.

- American Conference of Governmental Industrial Hygienists (ACGIH)
- Occupational Safety and Health Administration (OSHA)
- Provincial Health and Safety regulations (CAN)
- National Institute for Occupational Safety and Health (NIOSH):
- American Welding Society (AWS)
- Welding equipment manufacturers