Welding Safety and Health Considerations

The amount of exposure to individuals can depend upon work practices, ventilation, and location. Will the work be done in wide open areas, inside a building adjacent to other work processes and people, or potentially even in a confined space?

BY GREG ZIGULIS

Welding safety and health can be a broad topic and mean many things. To talk about some considerations for safe work, perhaps it would be good to start with a definition of welding. Welding is a process that joins materials together by melting a metal work piece along with a filler to form a strong joint. There are different types of welding, but oxygen-fuel welding (like oxy-acetylene) and electric welding are the most common.

There are many considerations for electric welding safety. They include ensuring the safe installation of primary and secondary voltage lines, proper grounding connections, cable and clip insulation, proper selection of welding rods, and the exact work environment. An article in the April 2014 edition of *OH&S* summarized the avoidance of hazards such as electric shock, fumes and gases, fires and explosions, insufficient PPE, and other safety considerations.

Similarly, there are many considerations for oxygen-fuel welding, including proper fuel-gas selection; compressed gas cylinder integrity; storage location and method of securement; protection of valves, regulators, and hose lines; proper tip selection, gas distribution and regulation; proper valve opening and regulator pressure settings; welding rod selection; and safety devices such as check valves and flashback arrestors. And of course, again, the work environment.

Applicable regulations exist specific not only to welding, but also to the control of compressed gases, work within confined spaces, specific hazardous substances, and more. See the OSHA and MSHA web pages for applicable sections.

Other standards and work practice information that one could refer to include AWS Z49.1 (Safety in Welding, Cutting and Allied Processes), USACOE 385-1-1 (Chapter 10), and AIHA's publication "Welding Health and Safety: A Field Guide for OEHS Professionals," and welding supplier documents.

Assessment of Risk

A variety of types of fumes and gases can be created from welding, depending upon the types of welding materials used (gases, work pieces/base metal, welding rods). Fumes can contain aluminum, antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, silver, tin, titanium, vanadium, and zinc. Shielding and process gases can include argon, helium, nitrogen, carbon dioxide, nitric oxide, nitrogen dioxide, carbon monoxide, ozone, phosgene, and hydrogen fluoride.

What's the type of material that needs to be worked on? Most people probably know they shouldn't weld or cut on painted surfaces due to lead and other materials that can be in coatings. The amount of exposure to individuals can depend upon work practices, ventilation, and location. Will the work be done in wide open areas, inside a building adjacent to other work processes and people, or potentially even in a confined space?

People have been attuned to the standards that exist for chromium and cadmium for some time, and those are always high-priority assessment items if the risk of exposure from them exists. However, fewer might be aware that in 2013, ACGIH changed the Threshold Limit Values for manganese (TLV-TWA) to .02 milligrams per cubic meter of air (mg/m^3) (respirable fraction) over an eight-hour work period. This is a significant reduction; air sampling that may have indicated "acceptable" results before may no longer be acceptable.

A solid risk assessment should be conducted in advance of performing work on these factors and all potential hazards that need to be controlled. (See "Other Types of Hazards" on the following page.)

Types of Hazards

You probably already know several other general welding safety and health considerations that include electrical safety, proper PPE selection (including vision and skin protection), area control, hot work permits, and fire watches. However, all of us don't see risk the same. Some people would do what you wouldn't do and perhaps vice versa, based upon knowledge, experience, and perception.

Some examples of things that have gone wrong, along with some preventive measures, include:

- A welder was electrocuted while electric welding when he came in contact with materials being welded due to perspiration on clothing and lack of PPE. (Welders should keep dry insulation between their body and the metal being welded.)
- Welders doing hot work on special Teflon-like coatings on snow removal equipment needed to get medical treatment because of the fumes of decomposition. (Welders should know what they are working on and ensure proper ventilation and PPE, including respiratory protection.)
- In a large multi-story plant environment, a torch was found cut off from oxy-fuel lines. A person on another level did not know this since the welding apparatus was not controlled and turned on com-

pressed gases. This could have resulted in a confined area filling with flammable gas and creating an explosive environment. (Repairs on equipment should be performed only by qualified persons and equipment should be controlled/reconfigured to prevent unintentional operation.)

- Sparks have traveled through openings between building levels and ignited combustible products and, in one case, even a paint can. (Control areas with hot work permits, remove combustibles from the area, cover openings, use fire blankets if appropriate, and ensure appropriate fire extinguishing equipment and fire watches.)
- Some welding requires work with very limited space and awkward postures, creating ergonomic-related injuries. (Plan for assistance where possible, use holding devices where possible, and consider alternate work that could accomplish the same end result.)

Controlling the Hazards

It is suggested that you have an EHS Management System with corresponding procedures in place that provide for welding-related risk assessment and control. Review available guidelines and literature for some very helpful information.

Strategies for reducing exposures to welding fume can be found on the OSHA website (an OSHA Fact Sheet), as well as other publications. This can include cleaning of surfaces prior to work, ensuring there are no toxic residues/solvents, body positioning, general and local exhaust ventilation, the substitution of welding materials to less toxic types, and respiratory protection if necessary based upon ventilation and work practices.

Having an EHS Management System in place can include having welding safety checklists that can be of great help. That can include, of course, hot work permits where an organization requires them or feels they are necessary. Most everyone wants to be safe, but not everyone knows how and not everyone can easily access regulations and guidelines with the same ease. Making it easy for the welder, assistants, and others helping to identify hazards can help make the workplace safer.

Conclusion

Welding technology can be a fascinating art and science that takes a high degree of skill and care. There are risk factors associated with any type of welding process. Competent welders utilizing safe work practices and equipment, working within an EHS Management System framework for risk assessment and control, can perform welding and related processes in a safe and healthful manner. OHS

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