ENVIRONMENTAL AND HEALTH HAZARDS OF ARC WELDING

by:
Jefrey A. Gonzales
Teacher II, St. Francis National High School

Welding and its operation create a huge transformation in the field of industrialization, in other words, engineering sciences and advanced technological industries of the world will be paralyzed without welding operations. Welding refers to the operations, which two separated metals connect to each other due to the heat, pressure or combination of these factors. Basically, welding is more important in an industry with complex structures and building goals.

Meanwhile, environment considerations today tend to control, guide and develop engineering processes affecting both men and environment. According theoretical application and the ecological advancement both in health and environment, the melting of filler metal, base metal and the coating on base metal during welding processes and subsequently the gases formed release minute, solid particles into the air creating a plume and is called welding fume. The potential risk on breathing exposures may lead to acute or chronic respiratory diseases these risks may include asphyxiation due to dangerous inhalants, damage to skin and eye due to ultraviolet light, chemical or electrical fires, and long-term negative effects from fumes. Proper procedure and knowledge in health and sanitation is considered in order to control, guide and develop engineering processes affecting both health and environment.

Eventually, most of the small and medium enterprises (SMEs) have poor working conditions contributing to worker’s safety and health problem. Workers in different industries such as construction, factories, mining, manufacturing, metallurgy, railroad, petrochemical, ironworks, shipbuilding or steel industries, suffer from various kinds of
respiratory illness or pulmonary infection. Toxic gases like nitric oxide, carbon monoxide, ozone and nitrogen dioxide are produced from welding processes. These toxic gases can cause headache, pulmonary edema and drowsiness. Phosphine and phosgene are the other gases which are a health hazard. Ozone, a colorless gas produced during welding, is a powerful irritant which attacks the cell membrane and the mucous membrane. Ordinarily safe gases become too concentrated if welders work in confined space, and cause edema, filling lungs with water. Nitrous gases (nitrogen oxides) form when the nitrogen and oxygen in the air react with the hot arc and the hot base metal. NO2 is present in workplaces where combustion processes or gas welding is in use.

Working environment and conditions create serious dangers and diseases that threatens the workers. For example, welders are working in construction, mine, metallurgy industry, petrochemical and metal industry, faced with respiratory diseases more than others due to the contaminated workplace and significant height difference relative to sea level. There are different methods for welding, which all of these methods produce toxic and hazardous gases. Produced and dangerous gases in welding processes include carbon dioxides, nitrogen dioxides and ozone and these gases are toxic and have suffocating effects. Breathing and lung problems and severe headaches are other symptoms of these gases’ inhalation. The use of inappropriate raw materials or impurities on the metal surface leads to produce other gases like phosgene and ozone. Ultraviolet (UV) radiation forms in arc welding, this radiation leads to oxygen ionization; thus, ozone gas produces finally and bluish color belongs to produced ozone, and the inhaling smell in the electric sparks is the ozone smell.

According to environmental science education, produced gases in welding are toxic and hazardous, and ozone is not the exception too. This gas is very strong and creates problems in trace amounts such as cough, nausea, bronchitis and drowsiness, and in large quantities lead to death. Produced ozone in welding can make breathing problems because of its nature (low solubility in water). Nitrogen oxides include nitrogen
monoxide and nitrogen dioxide is other produced gases with dangerous effects. These oxides produced in the presence of UV radiation and nitrogen of atmosphere warming. Nitrogen dioxide produced during the welding process, without a doubt the amount of this gas is more than other gases. These kinds of oxides have very dangerous effects upon human life. These gases create problems even in trace amounts such as headache, cough, shortness of breath, eye irritation and insomnia. The important note about these oxides is exposed time. For example, very short exposed time with 50 ppm nitrogen monoxide leads to acute respiratory problems.

In this regard, some protocol should be ratified in all the countries, which determine the allowed exposed time and the allowable amount of these compounds in order to minimize the risks. Carbon monoxide is another toxic and hazardous gas, which produces in the welding process. This gas is the result of UV radiation on carbon dioxide, and leads to chemical suffocation and interferes in natural absorption of oxygen by blood. Therefore, the released gases in welding operation are toxic and hazardous gases, and lack of knowledge and safety tips leads to irreparable effects and these gases are among the pollutants, which can cause environmental problems as released into the atmosphere. These are severe problems and cannot be ignored; so, practical and definitive solutions should be proposed to prevent these effects. Create awareness is the most important way to achieve this goal. Many problems are due to lack of awareness, and appropriate knowledge is the only solution in this problem. Necessary and vital points should be taught to welders by holding training classes, because they should have suitable reactions in different conditions. Use of proper ventilation systems is important too. These systems transfer dangerous gases and fumes outside the workplace, and suitable filters prevent them to enter into the atmosphere.
References:


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