

EMISSIONS FROM WELDING IN HYDROGEN SULPHIDE-CONTAMINATED AIR

SUMMARY

This report describes the results of a laboratory study of the major products formed when arc welding is carried out in an atmosphere contaminated with hydrogen sulphide (H_2S). It also examines the potential health effects of these products, and recommends preventive and protective measures to minimize the exposure of welders.

Shielded metal arc welding studies were carried out in a small welding chamber which contained a static atmosphere of 10 parts per million (ppm) H_2S . The Workers' Compensation Board of British Columbia specifies a permissible concentration of 10 ppm averaged over an 8-hour period.

The welding products of H_2S detected in this study were sulphur dioxide (SO_2) and sulphuric acid (H_2SO_4). Sulphur dioxide (and sulphurous acid formed when SO_2 dissolves in water vapour) represented approximately 35-60% of the welding emissions; the remainder was sulphuric acid.

Hydrogen sulphide was completely converted to oxidized products in the reaction conditions of this study. Most of the sulphur dioxide produced in the welding chamber did not remain as the free gas, but converted rapidly to sulphurous acid which condensed on the inside walls of the enclosure and on the sampling filter. In actual mill conditions, most of the sulphur dioxide produced by welding would have an opportunity to dissipate away from the welder's breathing zone before reacting with water. Consequently, sulphur dioxide may remain in the gaseous state for longer periods than in this study.

Airborne sulphur dioxide and sulphuric acid have similar health effects. Short-term exposures can cause irritation of the eye, nose, throat, and lungs, and reduce lung function. Workers can develop a tolerance to sulphur dioxide and sulphuric acid upon repeated exposures. About

10-20% of the adult population is especially susceptible to irritation by sulphur dioxide. These individuals have an immediate coughing or choking reaction to the gas at concentrations that are tolerable to most people.

Welders can minimize their exposure to sulphur dioxide, acid mists, and other welding contaminants by taking appropriate preventive and protective measures. Prior to welding in an H_2S atmosphere, it is recommended that the air be monitored to determine the extent of contamination; indicator tubes or portable gas monitors could be used for this purpose.

Local exhaust ventilation is the preferred method to reduce exposure to welding fumes. Respiratory protection may be necessary if ventilation is not feasible.

Selection of the appropriate respirator depends on the entire array of contaminants and their concentrations in the worker's breathing zone, and should be done by a qualified individual. Only NIOSH-certified (National Institute for Occupational Safety and Health) respirators should be chosen, and manufacturers' specifications reviewed carefully. Most manufacturers supply air-purifying cartridges certified for protection against sulphur dioxide at concentrations no greater than 50 to 100 ppm. These are commonly referred to as "acid gas" cartridges.

During this study, problems were encountered with the compressed gas mixture ordered from the supplier at a concentration of 1000 ppm hydrogen sulphide. After three months, the gas mixture contained no hydrogen sulphide. This problem should be noted by mills who use compressed gas mixtures to calibrate hydrogen sulphide gas monitors, gas chromatographs or other sulphur gas measuring instruments.