

SUMMARY

During welding on metals that are covered by resistant coatings, welders may be exposed to airborne chemicals in addition to those normally present when welding on uncoated metals. Research on coatings indicates that some contaminants can greatly exceed the exposure limits under unfavourable conditions such as in confined or limited spaces, when the welder's head is in the plume, and when the coating film is thick. Overexposures are easily prevented if correct procedures are followed.

In this report, a review is given of laboratory studies of the contaminants emitted during welding on coatings containing six different metal pigments and five different binders (epoxy, polyurethane, alkyd, vinyl, and chlorinated rubber). Next, health effects and expected levels of specific contaminants are given and compared to exposure limits. The levels of gases and vapours that welders may be exposed to are summarized in a table. Recommendations are given for good practices.

Resistant coatings (called "coatings" in this report) provide long-term protection of metal under corrosive conditions. Popularly known as "paints," coatings fall into two classes: primers and topcoats. Anti-rust primers, applied in a relatively thin film directly to the steel, are not generally removed before welding. Topcoats are not routinely welded on. However, they may be heated or burned during repair and demolition work. If possible, welders should determine the composition of the coating prior to welding. The material safety data sheet is a good place to look for this information.

Two ingredients in coatings can generate hazardous contaminants during welding: the pigment and the binder. Pigments are usually metallic compounds. Upon intense heating, these vaporize and may be inhaled as microscopic solid particles. The metals vary in toxicity. Lead, chromium, zinc, and barium commonly exceed exposure limits during welding. The concentration of each metal in the fume depends on the metal content of the coating and on the film thickness.

The binder (sometimes called the resin) will give rise to a variety of substances. All binders may produce carbon monoxide and formaldehyde at levels that exceed the exposure limit. In addition, chlorinated rubber and vinyl binders may generate hydrogen chloride. Finally, polyurethane resins may release excessive amounts of toluene diisocyanate (TDI).

Concentrations of contaminants in the welder's breathing zone will be influenced not only by the composition of the coating, but by three other conditions: thickness of the film, ventilation, and welding position.

The investigations reviewed in this report demonstrate that, for the primers and topcoats commonly used in B.C. pulp mills, the welder need not be concerned about ill effects from excessive levels of nitrogen oxides, phosgene or carbon dioxide. Questions still remain unanswered, however, about the hazards to welders of chromium, barium compounds, and polynuclear aromatic hydrocarbons such as benzo(a)pyrene.

To assess risks, workers should know the ingredients of the coating they are going to weld on. If it contains zinc, chromium, lead, or barium, special precautions may be necessary. Polyurethane, because it may generate hydrogen cyanide and toluene diisocyanate (TDI), is especially hazardous. All resins may generate carbon monoxide and formaldehyde.

Worksite conditions such as thick coatings and poor ventilation can greatly increase the risk of overexposure. Effective local exhaust ventilation will minimize welder's exposure. Ventilation adequate to control exposure to metals in the fume will also control toxic gases and vapours.

Only air monitoring can tell you what concentrations of contaminants the welder is breathing. If dangerous levels of contaminants are suspected, test welds should be carried out before work begins. Metals must be sampled and analysed by experienced occupational hygienists, but the gases and vapours from coatings can be checked by indicator tubes.