Effects of Welding on Health IV
Effects of Welding on Health IV

An up-dated (December 1980-June 1982) literature survey and evaluation of the data recorded since the publication of the first report, to understand and improve the occupational health of welding personnel.

By
Winifred G. Palmer

Submitted by:
Tracor Jitco
1776 E. Jefferson Street
Rockville, MD 20852

Submitted to:
SAFETY AND HEALTH COMMITTEE
AMERICAN WELDING SOCIETY
550 N.W. LeJeune Road
Miami, FL 33126
Contents

Personnel ......................................................... v
Acknowledgements ................................................. vii
Preface ............................................................ ix
Introduction ....................................................... xi
Executive Summary ............................................... xiii
Technical Summary ............................................... xv

1. The Exposure ................................................ 1
   1.1 Fumes ................................................... 1
   1.2 Gases .................................................... 5
   1.3 Protective Coatings ....................................... 7
   1.4 Electromagnetic Radiation ............................. 9
   1.5 Noise .................................................... 10

2. Effects of Welding on Human Health ...................... 11
   2.1 Respiratory Tract ...................................... 11
   2.2 Cancer .................................................. 15
   2.3 Effects on the Ear and Hearing ........................ 19
   2.4 Effects on the Eye and Vision ........................ 19
   2.5 Effects on the Skin .................................... 20
   2.6 Effects on the Cardiovascular System ............... 21
   2.7 Effects on the Nervous System ........................ 21
   2.8 Effects on the Liver ................................... 22
   2.9 Effects on the Musculoskeletal System .............. 22
   2.10 Effects on the Urogenital Tract ..................... 23
   2.11 Effects on the Teeth and Oral Cavity .............. 23
   2.12 Metal Fume Fever .................................... 23
   2.13 Sensitivity to Fume Components ..................... 23
   2.14 Biochemical Changes ................................ 24
   2.15 Human Fatality ....................................... 25
   2.16 Occupational Medicine ................................ 25

3. Toxicologic Investigations in Animals and in Cell Cultures .... 25
   3.1 Animal Studies ......................................... 25
   3.2 In Vitro Studies ........................................ 29

References ....................................................... 31
Bibliography ..................................................... 37
Preface

This literature review has been prepared for the Safety and Health Committee of the American Welding Society to provide an assessment of current knowledge of the effects of welding on health, as well as to aid in the formulation of research projects in this area, as part of an ongoing program sponsored by the Society. Previous work has included studies of the fumes, gases, radiation, and noise generated during various forms of arc welding (see Bibliography). Conclusions based on this review and recommendations for further research are presented in the introductory portions of the report. Section 1 summarizes recent studies of the occupational exposures. Section 2 contains information related to the human health effects of exposure to byproducts of welding operations. Section 3 discusses studies of the effects of welding emissions on laboratory animals and in vitro cell systems. Referenced materials are available from Tracor Jitco, Inc.
Introduction

The health of workers in the welding environment is a major concern of the American Welding Society. To stay abreast of this subject, the health literature is periodically reviewed and published in the report *Effects of Welding on Health*. Three volumes have been published to date (Refs. 135, 143, and 144); the first covered data published prior to 1978, while the latter two covered the periods 1978 to May, 1979 and June, 1979 to December 1980, respectively. The current report included information that was published between December, 1980 and June, 1982, and should be read in conjunction with the previous volumes for a comprehensive treatment of the literature on the *Effects of Welding on Health*.

Included in this volume are studies of the characteristics of welding emissions that may have impact on the control technologies necessary to protect the welding worker (Section I). Considerable discussion is devoted to ozone which may become a greater problem to welders as improved ventilation and decreased fume exposures reduce the rate of degeneration of this hazardous gas. Much recent research has focused on chromium and nickel, since exposure to certain chemical forms of these metals may cause serious chronic health problems.

In keeping with previous volumes, the health studies are organized according to the organ system affected. The respiratory tract, the primary route of entry of welding fumes and gases into the body, also is a major target organ of a number of components of these emissions. Acute (e.g., metal fume fever, cadmium poisoning) as well as potential chronic respiratory effects (e.g., emphysema, cancer) of welding emissions are of concern. The latter are far less well understood and whether or not there is an excess risk of cancer from these exposures has not been established. Continued research in the form of epidemiologic studies, investigations with laboratory animals, and *in vitro* genotoxicity studies will help to resolve this question.