Effects of Welding on Health, XIV

American Welding Society®

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Prepared for the
AWS Safety and Health Committee

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Abstract

This literature review was prepared under contract to the American Welding Society for its Safety and Health Committee. The review deals with studies of the health effects of fumes, gases, radiation, and noise generated during various welding processes. Section 1 summarizes recent studies of occupational exposures, Section 2 contains information related to human health effects, and Section 3 discusses the effects of exposures in animals and cell cultures.

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Foreword

This literature review was prepared for the Safety and Health Committee of the American Welding Society to provide an assessment of current information concerning the effects of welding on health, as well as to aid in the formulation and design of research projects in this area, as part of an ongoing program sponsored by the committee. Previous work consists of the reports Effects of Welding on Health I through XIII each covering approximately 2 to 3 years. Conclusions based on this review and recommendations for further research are presented in the introductory portions of the report. The current report includes information published between January 2003 and December 2005. In addition, an appendix has been added with short summaries of articles on the effects of welding on human health published between 2006 and 2009.

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Glossary*

ACGIH	American Conference of Governmental Industrial Hygienists
BALF	Bronchoalveolar lavage fluid
CI	Confidence Interval
COPD	Chronic obstructive pulmonary disease
Cr(III)	Trivalent chromium
Cr(VI)	Hexavalent chromium
CT	Computed tomography
ELF-EMF	Extremely low frequency electromagnetic field
Dyspnea	Difficulty breathing; shortness of breath
FCAW	Flux cored arc welding
GMAW	Gas metal arc welding
GTAW	Gas tungsten arc welding
Ig	Immunoglobulin
IL	Interleukin (a class of proteins or cytokines important in regulation of the immune system/lymphocyte function)
Leukocyte	White blood cell
MAC	Maximum Allowable Concentration
mRNA	Messenger ribonucleic acid (template for protein synthesis; mRNA transmits genetic information from DNA to the cytoplasm where proteins are synthesized)
n	Number
nm	Nanometer
NIOSH	National Institute for Occupational Safety and Health
OA	Occupational asthma
OR*	Odds ratio
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbons
PEL	Permissible Exposure Limit
PMN	Polymorphonuclear leukocyte
ROS	Reactive oxygen species
RR*	Relative risk
SMAW	Shielded metal arc welding
SMR*	Standardized mortality ratio
SOD	Superoxide dismutase
TLV	Threshold Limit Value
µm	Micrometer
µg	Microgram
UV	Ultraviolet

*Abbreviations for commonly used pulmonary function tests and for epidemiological terminology used in this document are found in Appendix A and B, respectively. The appendices describe the derivation of these terms and how they are used.

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Table of Contents

Page No.

Page No.

List of Tables

List of Figures

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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.* Thirteen volumes have been published to date; the first covered data published before 1978, while the remainder covered 2- to 3-year periods between 1978 and December 2002. The current report includes information published between January 2003 and December 2005. In addition, an appendix has been added with short summaries of articles on the effects of welding on human health published between 2006 and 2009. This volume should be read in conjunction with previous volumes for a comprehensive treatment of the literature on the *Effects of Welding on Health.* Included in Section 1 of this volume are studies of the characteristics of welding emissions that may have an impact on the control technologies necessary to protect the welder. In keeping with previous volumes, health reports and epidemiological studies of humans are discussed in Section 2 and organized according to the affected organ system. Research studies in animals and cell cultures are discussed in Section 3.

Many of the studies on the effects of welding on health published during the current report period focused on matters that have been explored in the older literature. The effects of welding on the respiratory tract continue to be examined and attention has been paid to the elevated incidence of pneumonia among active welders. Studies in animals suggest that SMAW of stainless steel may be responsible for this effect and that the soluble chromium component of SMAW fumes plays an important role in the suppression of the pulmonary defense responses against bacterial infection. The neurological effects of aluminum and manganese continue to receive attention. Much of the research has focused on whether exposure to manganese in welding fumes can cause Parkinson's disease or a Parkinson's disease-like syndrome (parkinsonism). Several large epidemiologic studies published during this report period addressed this question and most indicate that welders do not have an elevated risk for this condition.