



# Effects of Welding on Health, XII

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**American Welding Society**



**Key Words**—Welding, health, cancer, disease, exposure, fumes, gases, literature review, metal fume fever, noise, radiation, toxicology

## Effects of Welding on Health, XII

Prepared for  
AWS Safety and Health Committee

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### Abstract

This literature review, with 216 citations, was prepared under contract to the American Welding Society for its Safety and Health Committee. The review deals with studies of the fumes, gases, radiation, and noise generated during various welding processes. Section 1 summarizes recent studies of occupational exposures, Section 2 contains information related to the human health effects, and Section 3 discusses the effects of welding on animals and cell cultures.



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# Foreword

(This Foreword is not a part of *Effects of Welding on Health, XII*, but is included for informational purposes only.)

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 on going program sponsored by the Committee. Previous work consists of the reports *Effects of Welding on Health I* through *XI* each covering approximately 18 months to two years. Conclusions based on this review and recommendations for further research are presented in the introductory portions of the report. Referenced materials are available from:

Biomedical Toxicology Associates  
6184 Viewsite Drive  
Frederick, MD 21701  
(301) 662-0783

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# Glossary\*

ACGIH	American Conference of Governmental Industrial Hygienists
BALF	Bronchoalveolar lavage fluid
CI	Confidence Interval
Cr(III)	Trivalent chromium
Cr(VI)	Hexavalent chromium
ELF	Extremely low frequency
EMF	Electromagnetic field
FCAW	Flux cored arc welding
GMAW	Gas metal arc welding
GTAW	Gas tungsten arc welding
IgA	ImmunoglobulinA
IgM	ImmunoglobulinM
IL-1	Interleukin-1
IL-4	Interleukin-4
Leukocyte	White blood cell
MRI	Magnetic resonance imaging
n	number
nm	nanometer
NIOSH	National Institute for Occupational Safety and Health
OR	Odds ratio
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbons
PEL	Permissible Exposure Limit
PET	Positron emission tomography
PMN	Polymorphonuclear leukocyte
PMR*	Proportional mortality ratio
RR*	Relative risk
SIR*	Standardized incidence ratio
SCE	Sister chromatid exchange
SMAW	Shielded metal arc welding
SMR*	Standardized mortality ratio
TLV	Threshold Limit Value
TNF	Tumor necrosis factor
TWA	Time-weighted average
µm	micrometer
µg	microgram
µmol	micromole per liter
µT	microTesla
UV	Ultraviolet
ZnO	Zinc oxide

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



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# Supporting Organizations

ESAB Welding and Cutting Products  
Hobart Brothers Company  
Praxair, Incorporated  
The Lincoln Electric Company

Many other organizations have also made contributions to support the ongoing program from May 1979 to the present.

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