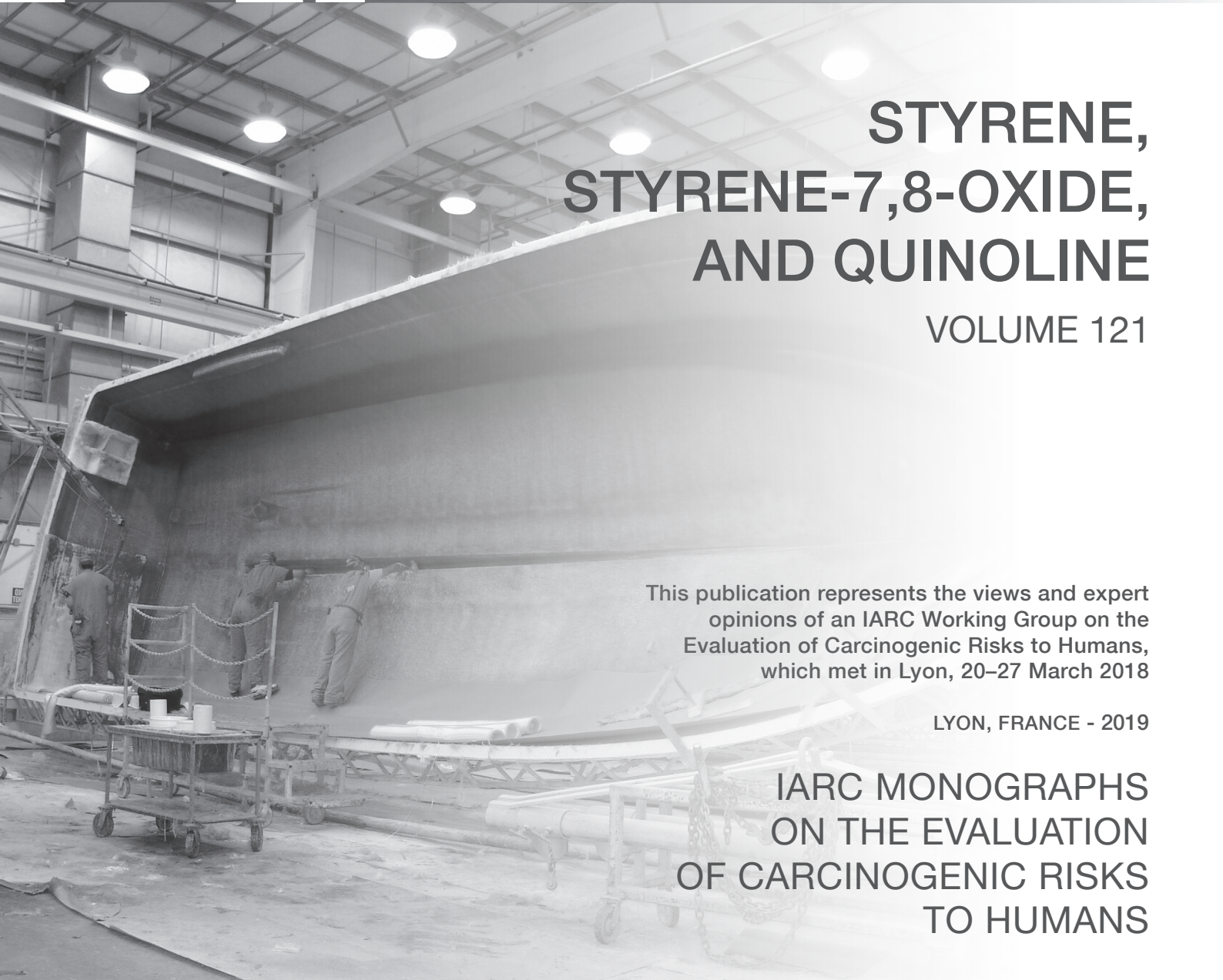




STYRENE, STYRENE-7,8-OXIDE, AND QUINOLINE

VOLUME 121

IARC MONOGRAPHS
ON THE EVALUATION
OF CARCINOGENIC RISKS
TO HUMANS



STYRENE, STYRENE-7,8-OXIDE, AND QUINOLINE

VOLUME 121

This publication represents the views and expert opinions of an IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, which met in Lyon, 20–27 March 2018

LYON, FRANCE - 2019

**IARC MONOGRAPHS
ON THE EVALUATION
OF CARCINOGENIC RISKS
TO HUMANS**

IARC MONOGRAPHS

In 1969, the International Agency for Research on Cancer (IARC) initiated a programme on the evaluation of the carcinogenic risk of chemicals to humans involving the production of critically evaluated monographs on individual chemicals. The programme was subsequently expanded to include evaluations of carcinogenic risks associated with exposures to complex mixtures, lifestyle factors and biological and physical agents, as well as those in specific occupations. The objective of the programme is to elaborate and publish in the form of monographs critical reviews of data on carcinogenicity for agents to which humans are known to be exposed and on specific exposure situations; to evaluate these data in terms of human risk with the help of international working groups of experts in carcinogenesis and related fields; and to indicate where additional research efforts are needed. The lists of IARC evaluations are regularly updated and are available on the Internet at <http://monographs.iarc.fr/>.

This programme has been supported since 1982 by Cooperative Agreement U01 CA33193 with the United States National Cancer Institute, Department of Health and Human Services. Additional support has been provided since 1986 by the European Commission Directorate-General for Employment, Social Affairs, and Inclusion, initially by the Unit of Health, Safety and Hygiene at Work, and since 2014 by the European Union Programme for Employment and Social Innovation "EaSI" (2014–2020) (for further information please consult: <http://ec.europa.eu/social/easi>). Support has also been provided since 1992 by the United States National Institute of Environmental Health Sciences, Department of Health and Human Services. The contents of this volume are solely the responsibility of the Working Group and do not necessarily represent the official views of the United States National Cancer Institute, the United States National Institute of Environmental Health Sciences, the United States Department of Health and Human Services, or the European Commission.

Published by the International Agency for Research on Cancer,
150 cours Albert Thomas, 69372 Lyon Cedex 08, France
©International Agency for Research on Cancer, 2019
On-line publication, September 2019

Distributed by WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland
(tel.: +41 22 791 3264; fax: +41 22 791 4857; email: bookorders@who.int).

Publications of the World Health Organization enjoy copyright protection in accordance with the provisions of Protocol 2 of the Universal Copyright Convention. All rights reserved.

Corrigenda to the *IARC Monographs* are published online at <http://publications.iarc.fr>
To report an error, please contact: editimo@iarc.fr



Co-funded by the European Union

The International Agency for Research on Cancer welcomes requests for permission to reproduce or translate its publications, in part or in full. Requests for permission to reproduce or translate IARC publications – whether for sale or for non-commercial distribution – should be addressed to the IARC Communications Group at: publications@iarc.fr.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Health Organization concerning the legal status of any country, territory, city, or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the World Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

The *IARC Monographs* Working Group alone is responsible for the views expressed in this publication.

IARC Library Cataloguing in Publication Data

Styrene, Styrene-7,8-oxide, and Quinoline / IARC Working Group on the Evaluation of Carcinogenic Risks to Humans (2018: Lyon, France)

(IARC monographs on the evaluation of carcinogenic risks to humans ; volume 121)

1. Carcinogens 2. Styrene – adverse effects 3. Epoxy Compounds – adverse effects 4. Quinolines – adverse effects
5. Risk Factors

I. International Agency for Research on Cancer II. Series

ISBN 978-92-832-0188-5
ISSN 1017-1606

(NLM Classification: W1)



This volume of the *IARC Monographs* provides evaluations of the carcinogenicity of quinoline, styrene, and styrene-7,8-oxide.

Quinoline and styrene are present in air pollution and in tobacco smoke. Quinoline also occurs in the processing of petroleum and shale oil, and is found in groundwater and soil at sites contaminated by coal tar and creosote. Quinoline and styrene are high production volume chemicals. Quinoline is used to produce various drugs and dyes. Styrene is primarily used in the production of polystyrene polymers. Styrene-7,8-oxide is primarily used to produce epoxy resins. Styrene-7,8-oxide is the primary metabolite of styrene in humans. Styrene and styrene-7,8-oxide are found in workplace air, particularly in the reinforced plastics industry and the rubber industry. Exposure to these agents may occur in the general population as well as in various occupational settings.

An *IARC Monographs Working Group* reviewed epidemiological evidence, animal bioassays, and mechanistic and other relevant data to reach conclusions as to the carcinogenic hazard to humans of environmental or occupational exposure to these agents.

