



German Chemical Society
Gesellschaft Deutscher Chemiker

GDCh-Advisory Committee
on Existing Chemicals of
Environmental Relevance (BUA)

1,2-Dichloroethane

BUA Report 163

(December 1994)



S. Hirzel

Wissenschaftliche Verlagsgesellschaft 1997

GDCh-Advisory Committee on Existing Chemicals of Environmental Relevance (BUA)

Chairman:

Prof. Dr. E. Bayer, Institut für Organische Chemie der Universität Tübingen

Members:

Dr. G. Alfke, Mineralölwirtschaftsverband e. V., Hamburg

Prof. Dr. K. Ballschmiter, Abteilung Analytische Chemie und Umweltchemie der Universität Ulm

Dr. R. Bias, BASF AG, Emissionsüberwachung und Ökologie, Ludwigshafen a. Rh.

Prof. Dr. O. Fränze, Geographisches Institut der Universität Kiel

Prof. Dr. H.-P. Gelbke, BASF AG, Toxikologie, Ludwigshafen a. Rh.

Prof. Dr. H. Greim, GSF — Institut für Toxikologie, Neuherberg (Vice Chairman)

Dir. und Prof. Dr. J. Hahn, Institut für Wasser-, Boden- und Lufthygiene des Umweltbundesamtes, Berlin

Dr. H. Heÿn, HOECHST AG, Ressortgruppe Umwelt, Frankfurt am Main

Dr. H. Jungen, Deutsche Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle e. V., Hamburg

Dir. und Prof. Dr. D. Kayser, Bundesinstitut für gesundheitlichen Verbraucherschutz und Veterinärmedizin, Berlin

Dr. W. Mayr, DEGUSSA AG, Abteilung Umweltschutz/Industrielle Toxikologie, Hanau

Dr. W. Mühlhölzl, Bayerische Landesanstalt für Wasserforschung, München

Prof. Dr. P. Müller, Institut für Biogeographie, Universität des Saarlandes, Saarbrücken

Prof. Dr. R. Nagel, Institut für Hydrobiologie der Technischen Universität Dresden

Dir. und Prof. Dr. H. Neidhard, Umweltbundesamt, Berlin

MinRat Prof. Dr. U. Schlottmann, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit, Bonn

Dr. N. Schön, BAYER AG, Umweltschutz/Produktsicherheit, Leverkusen

Vizepräsident Dr. A. Troge, Umweltbundesamt, Berlin

Collaborators and Guests:

Dr. K. H. Adlfinger, Initiative Umweltrelevante Altstoffe, Frankfurt am Main

Priv.-Doz. Dr. J. Ahlers, Fachgebiet IV 1.2 des Umweltbundesamtes, Berlin

Dr. R. Bartsch, GSF - Institut für Toxikologie, Neuherberg

Dr. S. Ettel, Institut für Organische Chemie der Universität Tübingen

Prof. Dr. F. H. Frimmel, DVGW-Forschungsstelle am Engler-Bunte-Institut der Universität Karlsruhe

Dr. R. F. Hertel, Fachgruppe 821 des Bundesinstituts für gesundheitlichen Verbraucherschutz und Veterinärmedizin, Berlin

Dr. J. Koppenhöfer, Institut für Organische Chemie der Universität Tübingen

Dr. J. Leuschner, Laboratorium für Pharmakologie und Toxikologie, Hamburg

Frau Dr. I. Mangelsdorf, GSF - Institut für Toxikologie, Neuherberg

Dr. J. Oberhansberg, BG Chemie, Heidelberg

Dr. H.-W. Rothkopf, EVC (Deutschland) GmbH, Wilhelmshaven

Frau Dr. H. Sterzl-Eckert, GSF - Institut für Toxikologie, Neuherberg

Frau Dr. F. Stibane, Laboratorium für Pharmakologie und Toxikologie, Hamburg

Dipl.-Biol. R. Uszkoreit, Institut für Pharmakologie und Toxikologie, Hamburg

Dr. D. Vogel, Institut für Organische Chemie der Universität Tübingen

Frau Dipl.-Biol. L. Weis, Institut für Organische Chemie der Universität Tübingen

Frau Dr. K. Widmann, Institut für Organische Chemie der Universität Tübingen

GDCh Office:

Dr. H. Behret, GDCh, Frankfurt am Main

1,2-Dichloroethane

BUA Report 163

(December 1994)

edited by the GDCh-Advisory
Committee on Existing Chemicals
of Environmental Relevance

Beratergremium für
Umweltrelevante Altstoffe (BUA)



S. Hirzel

Wissenschaftliche Verlagsgesellschaft 1997

Dr. H. Behret
Gesellschaft Deutscher Chemiker
Postfach 90 04 40
D-60444 Frankfurt am Main

BKL-Übersetzung

This book was carefully produced. Nevertheless, authors, editors and publisher do not warrant the information contained therein to be free of errors. Readers are advised to keep in mind that statements, data, illustrations, procedural details or other items may inadvertently be inaccurate.

The use of general descriptive names, trade names, trademarks, etc. in a publication, even if not specifically identified, does not imply that these names are not protected by the relevant law and regulations.

Die Deutsche Bibliothek — CIP-Einheitsaufnahme

1,2-Dichloroethane / ed. by the GDCh Advisory Committee on Existing Chemicals of Environmental Relevance.— (December 1994). — Stuttgart: Hirzel ; Stuttgart : Wiss. Verl.-Ges., 1997
(BUA report; 163)
Dt. Ausg. u.d.T.: 1,2-Dichlorethan
ISBN 3-7776-0769-X

All rights reserved. No part of this publication may be translated, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without permission in writing from the publisher.

© 1997 S. Hirzel Verlag, Birkenwaldstraße 44, 70191 Stuttgart

Printed in acid-free and low-chlorine paper.

Printing and binding: Druckhaus Beltz, Hemsbach
Printed in F.R. Germany

Foreword

The German Chemicals Act (Chemikaliengesetz — ChemG) of 1980 stipulates that certain existing chemicals must be reported to the competent authority, if they exhibit properties which indicate that they may be hazardous, either alone or in combination with other substances.

In the summer of 1982, an Advisory Committee on Existing Chemicals of Environmental Relevance (BUA) was set up by the German Chemical Society (Gesellschaft Deutscher Chemiker — GDCh). It brings together representatives from the scientific community, the chemical industry and the governmental authorities. This Advisory Committee is responsible for elaborating appropriate solutions for substances of relevance for health and the environment on the basis of voluntary measures. It selects and examines existing chemicals from the aforementioned angles. The testing and evaluation are based on scientific criteria alone.

It was, therefore, necessary to develop priority setting procedures. In a first phase reports were only prepared for priority chemicals. Within the framework of a first priority setting procedure, chemicals were compiled from several priority lists and 135 chemicals were selected for detailed reports.

In a second priority setting procedure the survey of the German Chemical Industry Association (VCI) on all substances with a production volume of more than 10 tons per year was used as a starting list. Since this survey covered 4,600 chemicals, BUA decided to process the corresponding list in several stages. The first stage included approx. 1,050 substances with a production volume of more than 1,000 tons per year.

Detailed reports are drawn up on chemicals suspected of having a hazard potential and abridged reports on those presenting only a minor hazard potential, according to the current state of knowledge.

The detailed BUA reports take in both the published literature and data from industry. If data for the evaluation of the chemicals are not available, additional studies are recommended and the results are published as update to the reports. The reports serve as a basis for the instigation of administrative measures, when there are indications of risks to health or the environment.

Tübingen, May 1993

Ernst Bayer
Chairman of the Advisory Committee
on Existing Chemicals
of Environmental Relevance

Contents

| | |
|--------------------------------------|-------------|
| Summary and Conclusions | XI |
| Recommendations | XXVI |

1,2-DICHLOROETHANE

| | | |
|----------|--|-----------|
| 1 | Chemistry of the substance | 1 |
| 1.1 | Chemical identity..... | 1 |
| 1.2 | Composition of the technical product..... | 3 |
| 1.3 | Chemical properties | 5 |
| 2 | Physical properties | 7 |
| 3 | Analysis | 13 |
| 3.1 | Determination in air..... | 13 |
| 3.2 | Determination in water | 20 |
| 3.3 | Determination in soil, sediment, and biological samples..... | 29 |
| 4 | Introduction into the environment during production, processing, application and disposal | 35 |
| 4.1 | Production procedures | 35 |
| 4.2 | Manufacturers and Processors, Production Quantities, Export, Import, Total Consumption..... | 39 |
| 4.3 | Processing, application, consumed quantities | 43 |
| 4.4 | Introduction into the atmosphere..... | 50 |
| 4.4.1 | Introduction during production and processing | 50 |
| 4.4.2 | Introduction during application | 51 |
| 4.4.3 | Introduction during storage | 53 |
| 4.5 | Introduction into the hydrosphere..... | 53 |
| 4.5.1 | Introduction during production and processing | 53 |
| 4.5.2 | Introduction during application | 54 |
| 4.6 | Introduction into the geo- and biospheres..... | 54 |
| 4.7 | Introduction through waste materials and their treatment | 55 |
| 4.8 | Balance of environmental emissions..... | 56 |

| | | |
|----------|---|-----------|
| 5 | Occurrence in the environment | 58 |
| 5.1 | Atmosphere..... | 58 |
| 5.1.1 | Ambient air concentrations | 58 |
| 5.1.1.1 | “Pure air“ areas | 58 |
| 5.1.1.2 | Cities of the Federal Republic of Germany | 60 |
| 5.1.1.3 | Occurrence in Europe | 60 |
| 5.1.1.4 | Occurrence in the USA and Japan..... | 65 |
| 5.1.1.5 | Ocean, Northern and Southern Hemispheres..... | 68 |
| 5.1.2 | Ground air | 69 |
| 5.1.3 | Indoor air..... | 70 |
| 5.1.4 | Occupational exposure | 71 |
| 5.2 | Hydrosphere | 72 |
| 5.2.1 | Surface water..... | 72 |
| 5.2.1.1 | Ocean water..... | 72 |
| 5.2.1.2 | Rivers..... | 73 |
| 5.2.2 | Sediments | 80 |
| 5.2.3 | Rainwater..... | 81 |
| 5.2.4 | Ground and drinking water..... | 81 |
| 5.2.5 | Percolation and restricted-flow water from waste disposal sites | 87 |
| 5.2.6 | Wastewater | 88 |
| 5.2.7 | Sewage sludge | 89 |
| 5.3 | Geosphere | 89 |
| 5.3.1 | 1,2-dichloroethane in soil | 89 |
| 5.4 | Biosphere..... | 90 |
| 5.4.1 | 1,2-dichloroethane levels in animals | 90 |
| 5.4.2 | 1,2-dichloroethane levels in man..... | 91 |
| 5.4.3 | 1,2-dichloroethane levels in food..... | 93 |
| 5.5 | Natural sources..... | 94 |
| 6 | Environmental behaviour | 95 |
| 6.1 | Transformation, degradation and degradation products | 95 |
| 6.1.1 | Biological degradation..... | 95 |
| 6.1.1.1 | Metabolism | 95 |

| | | |
|----------|---|------------|
| 6.1.1.2 | Aerobic degradation after inoculation with waste water or activated sludge | 102 |
| 6.1.1.3 | Aerobic degradation after inoculation with soil | 104 |
| 6.1.1.4 | Aerobic degradation after inoculation with water samples | 109 |
| 6.1.1.5 | Anaerobic degradation | 111 |
| 6.1.2 | Hydrolytic degradation | 111 |
| 6.1.3 | Photochemical degradation | 113 |
| 6.1.3.1 | Photochemical degradation in air | 113 |
| 6.1.3.2 | Photochemical degradation in water | 116 |
| 6.1.3.3 | Ozone Depletion Potential (ODP) | 116 |
| 6.2 | Accumulation | 117 |
| 6.2.1 | Bioaccumulation | 117 |
| 6.2.2 | Geoaccumulation | 117 |
| 6.3 | Partitioning and transport of 1,2-dichloroethane in and between environmental compartments | 118 |
| 6.3.1 | Henry constant | 118 |
| 6.3.2 | N-octanol/water partition coefficient | 121 |
| 6.3.3 | Soil sorption coefficients | 121 |
| 6.4 | Environmental fate | 122 |
| 7 | Ecotoxicology | 124 |
| 7.1 | Effects on aquatic organisms | 124 |
| 7.1.1 | Microorganisms | 124 |
| 7.1.2 | Plants | 127 |
| 7.1.3 | Invertebrates | 129 |
| 7.1.4 | Vertebrates | 134 |
| 7.2 | Effects on terrestrial organisms | 142 |
| 7.2.1 | Microorganisms | 142 |
| 7.2.2 | Plants | 142 |
| 7.2.3 | Invertebrates | 143 |
| 7.2.4 | Vertebrates | 144 |
| 7.3 | Effects on ecosystems | 145 |

| | | |
|----------|---|------------|
| 8 | Toxicity in homeothermic animals | 146 |
| 8.1 | General effects..... | 146 |
| 8.2 | Mode of action | 148 |
| 8.3 | Metabolism, toxicokinetics | 149 |
| 8.3.1 | Absorption..... | 149 |
| 8.3.2 | Tissue distribution | 151 |
| 8.3.3 | Biotransformation..... | 155 |
| 8.3.4 | Binding to macromolecules | 160 |
| 8.3.5 | Elimination | 166 |
| 8.4 | Acute toxicity..... | 168 |
| 8.5 | Skin and mucous membrane tolerance..... | 171 |
| 8.6 | Sensitizing effects | 173 |
| 8.7 | Subacute, subchronic and chronic toxicity | 173 |
| 8.8 | Genotoxicity | 193 |
| 8.9 | Carcinogenicity | 206 |
| 8.10 | Reproduction toxicity..... | 214 |
| 8.11 | Effects on the immune system..... | 217 |
| 8.12 | Other effects | 219 |
| 8.13 | Effects on man | 225 |
| 8.13.1 | Acute intoxication..... | 225 |
| 8.13.1.1 | Oral intake | 225 |
| 8.13.1.2 | Dermal exposure..... | 233 |
| 8.13.1.3 | Exposure by inhalation..... | 233 |
| 8.13.2 | Chronic intoxication..... | 238 |
| 8.13.3 | Epidemiological data | 239 |
| 8.13.4 | Metabolism, toxicokinetics in man..... | 243 |
| 9 | Substance-specific regulations | 246 |

References