

# Toxicological Profile for 1,1,2-Trichloroethane

**March 2021** 



# **DISCLAIMER**

Use of trade names is for identification only and does not imply endorsement by the Agency for Toxic Substances and Disease Registry, the Public Health Service, or the U.S. Department of Health and Human Services.

#### **FOREWORD**

This toxicological profile is prepared in accordance with guidelines\* developed by the Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA). The original guidelines were published in the *Federal Register* on April 17, 1987. Each profile will be revised and republished as necessary.

The ATSDR toxicological profile succinctly characterizes the toxicologic and adverse health effects information for these toxic substances described therein. Each peer-reviewed profile identifies and reviews the key literature that describes a substance's toxicologic properties. Other pertinent literature is also presented, but is described in less detail than the key studies. The profile is not intended to be an exhaustive document; however, more comprehensive sources of specialty information are referenced.

The focus of the profiles is on health and toxicologic information; therefore, each toxicological profile begins with a relevance to public health discussion which would allow a public health professional to make a real-time determination of whether the presence of a particular substance in the environment poses a potential threat to human health. The adequacy of information to determine a substance's health effects is described in a health effects summary. Data needs that are of significance to the protection of public health are identified by ATSDR.

Each profile includes the following:

- (A) The examination, summary, and interpretation of available toxicologic information and epidemiologic evaluations on a toxic substance to ascertain the levels of significant human exposure for the substance due to associated acute, intermediate, and chronic exposures;
- (B) A determination of whether adequate information on the health effects of each substance is available or in the process of development to determine levels of exposure that present a significant risk to human health of acute, intermediate, and chronic health effects; and
- (C) Where appropriate, identification of toxicologic testing needed to identify the types or levels of exposure that may present significant risk of adverse health effects in humans.

The principal audiences for the toxicological profiles are health professionals at the Federal, State, and local levels; interested private sector organizations and groups; and members of the public.

This profile reflects ATSDR's assessment of all relevant toxicologic testing and information that has been peer-reviewed. Staffs of the Centers for Disease Control and Prevention and other Federal scientists have also reviewed the profile. In addition, this profile has been peer-reviewed by a nongovernmental panel and was made available for public review. Final responsibility for the contents and views expressed in this toxicological profile resides with ATSDR.

Patrick N. Breysse, Ph.D., CIH

Director, National Center for Environmental Health and Agency for Toxic Substances and Disease Registry Centers for Disease Control and Prevention Christopher M. Reh, Ph.D. Associate Director

Chin M Reli

Agency for Toxic Substances and Disease Registry Centers for Disease Control and Prevention

## \*Legislative Background

The toxicological profiles are developed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA or Superfund). CERCLA section 104(i)(1) directs the Administrator of ATSDR to "...effectuate and implement the health related authorities" of the statute. This includes the preparation of toxicological profiles for hazardous substances most commonly found at facilities on the CERCLA National Priorities List (NPL) and that pose the most significant potential threat to human health, as determined by ATSDR and the EPA. Section 104(i)(3) of CERCLA, as amended, directs the Administrator of ATSDR to prepare a toxicological profile for each substance on the list. In addition, ATSDR has the authority to prepare toxicological profiles for substances not found at sites on the NPL, in an effort to "...establish and maintain inventory of literature, research, and studies on the health effects of toxic substances" under CERCLA Section 104(i)(1)(B), to respond to requests for consultation under section 104(i)(4), and as otherwise necessary to support the site-specific response actions conducted by ATSDR.

# **VERSION HISTORY**

| Date          | Description   |
|---------------|---|
| March 2021    | Final toxicological profile released                    |
| December 2019 | Draft for public comment toxicological profile released |
| October 2010  | Addendum to the toxicological profile released          |
| December 1989 | Final toxicological profile released                    |

## **CONTRIBUTORS & REVIEWERS**

## **CHEMICAL MANAGER TEAM**

Jennifer Przybyla, Ph.D. Julie M. Klotzbach, Ph.D.

Kelly Salinas, Ph.D. Mario Citra, Ph.D. Jenny S. Crisman, B.S.

ATSDR, Office of Innovation and Analytics, Toxicology Section, Atlanta, GA

SRC, Inc., North Syracuse, NY

#### **REVIEWERS**

## **Interagency Minimal Risk Level Workgroup:**

Includes ATSDR; National Center for Environmental Health (NCEH); National Institute for Occupational Safety and Health (NIOSH); U.S. Environmental Protection Agency (EPA); National Toxicology Program (NTP).

## Additional reviews for science and/or policy:

ATSDR Office of Community Health and Hazard Assessment; ATSDR, Office of Capacity Development and Applied Prevention Science; ATSDR, Office of Science; NCEH, Division of Laboratory Science; NCEH, Division of Environmental Health Science and Practice.

## PEER REVIEWERS

- 1. Ivan Rusyn, M.D., Ph.D.; Professor and Chair; Department of Veterinary Integrative Biosciences; College of Vet Medicine & Biomedical Sciences; Texas A&M University; College Station, Texas
- 2. James V. Bruckner, Ph.D.; Professor Emeritus of Pharmacology & Toxicology; Department of Pharmaceutical & Biomedical Sciences; College of Pharmacy; University of Georgia; Athens, Georgia
- 3. David C. Dorman, DVM, Ph.D., DABVT, DABT; Professor of Toxicology; North Carolina State University; College of Veterinary Medicine; Department of Molecular Biomedical Sciences; Raleigh, North Carolina

These experts collectively have knowledge of toxicology, chemistry, and/or health effects. All reviewers were selected in conformity with Section 104(I)(13) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended.

ATSDR scientists review peer reviewers' comments and determine whether changes will be made to the profile based on comments. The peer reviewers' comments and responses to these comments are part of the administrative record for this compound.

The listing of peer reviewers should not be understood to imply their approval of the profile's final content. The responsibility for the content of this profile lies with ATSDR.

# **CONTENTS**

|                                       | ii  |
|---------------------------------------|---|
|                                       | ii  |
| VERSION HISTORY                       | v   |
| CONTRIBUTORS & REVIEWERS              |   |
| CONTENTS                              | vi  |
| LIST OF FIGURES                       | ix  |
| LIST OF TABLES                        | х   |
|                                       |   |
| CHAPTER 1. RELEVANCE TO PUBLI         | C HEALTH 1                                      |
| 1.1 OVERVIEW AND U.S. EXPOS           | URES  |
| 1.2 SUMMARY OF HEALTH EFF             | ECTS  |
| 1.3 MINIMAL RISK LEVELS (MR           | Ls)7  |
| CHAPTER 2. HEALTH EFFECTS             |   |
| 2.1 INTRODUCTION                      |   |
| 2.2 DEATH                             | 31  |
| 2.3 BODY WEIGHT                       | 32  |
| 2.4 RESPIRATORY                       | 33  |
| 2.5 CARDIOVASCULAR                    | 34  |
| 2.6 GASTROINTESTINAL                  | 35  |
| 2.7 HEMATOLOGICAL                     | 35  |
| 2.8 MUSCULOSKELETAL                   | 36  |
| 2.9 HEPATIC                           | 36  |
| 2.10 RENAL                            | 38  |
| 2.11 DERMAL                           | 40  |
| 2.12 OCULAR                           | 40  |
|                                       | 41  |
|                                       | 41  |
|                                       | 42  |
| 2.16 REPRODUCTIVE                     | 44  |
|                                       | 45  |
| 2.18 OTHER NONCANCER                  | 46  |
| 2.19 CANCER                           | 46  |
|                                       | 47  |
| CHAPTER 3. TOXICOKINETICS, SUS        | CEPTIBLE POPULATIONS, BIOMARKERS, CHEMICAL      |
| · · · · · · · · · · · · · · · · · · · | 51  |
| 3.1 TOXICOKINETICS                    | 51  |
|                                       | 51  |
| <u>*</u>                              | 53  |
|                                       | 53  |
|                                       | 55  |
|                                       | acokinetic (PBPK)/Pharmacodynamic (PD) Models55 |
| 3.1.6 Animal-to-Human Extrapolat      | ions56  |
|                                       | ULATIONS THAT ARE UNUSUALLY SUSCEPTIBLE57       |
|                                       | E AND EFFECT                                    |
|                                       |   |
|                                       |   |
|                                       | R CHEMICALS60                                   |

| CHAPTER 4. CHEMICAL AND PHYSICAL INFORMATION                          | 62  |
|---|-----|
| 4.1 CHEMICAL IDENTITY   |     |
| 4.2 PHYSICAL AND CHEMICAL PROPERTIES                                  | 62  |
| CHAPTER 5. POTENTIAL FOR HUMAN EXPOSURE                               |     |
| 5.1 OVERVIEW  |     |
| 5.2 PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL                      |     |
| 5.2.1 Production  |     |
| 5.2.2 Import/Export   |     |
| 5.2.3 Use   |     |
| 5.2.4 Disposal  |     |
| 5.3 RELEASES TO THE ENVIRONMENT                                       |     |
| 5.3.1 Air   |     |
| 5.3.2 Water   |     |
| 5.3.3 Soil  |     |
| 5.4 ENVIRONMENTAL FATE  |     |
| 5.4.1 Transport and Partitioning                                      |     |
| 5.4.2 Transformation and Degradation                                  |     |
| 5.5 LEVELS IN THE ENVIRONMENT   |     |
| 5.5.1 Air   |     |
| 5.5.2 Water   |     |
| 5.5.3 Sediment and Soil   |     |
| 5.6 GENERAL POPULATION EXPOSURE                                       |     |
| 5.7 POPULATIONS WITH POTENTIALLY HIGH EXPOSURES                       |     |
| 5.7 TOFOLATIONS WITH FOTENTIALLY MIGH EAFOSURES                       | 62  |
| CHAPTER 6. ADEQUACY OF THE DATABASE                                   |     |
| 6.1 Information on Health Effects                                     |     |
| 6.2 Identification of Data Needs                                      |     |
| 6.3 Ongoing Studies   | 90  |
| CHAPTER 7. REGULATIONS AND GUIDELINES                                 | 91  |
| CHAPTER 8. REFERENCES   | 93  |
|   |     |
| APPENDICES  |     |
| APPENDIX A. ATSDR MINIMAL RISK LEVEL WORKSHEETS                       |     |
| APPENDIX B. LITERATURE SEARCH FRAMEWORK FOR 1,1,2-TRICHLOROETHANE     |     |
| APPENDIX C. FRAMEWORK FOR ATSDR'S SYSTEMATIC REVIEW OF HEALTH EFFECTS |     |
| DATA FOR 1,1,2-TRICHLOROETHANE  |     |
| APPENDIX D. USER'S GUIDE  |     |
| APPENDIX E. QUICK REFERENCE FOR HEALTH CARE PROVIDERS                 |     |
| APPENDIX F. GLOSSARY  |     |
| APPENDIX G. ACRONYMS, ABBREVIATIONS, AND SYMBOLS                      | G-1 |

# **LIST OF FIGURES**

| 1-1. | Health Effects Found in Animals Following Inhalation Exposure to 1,1,2-Trichloroethane    | 3  |
|------|---|----|
| 1-2. | Health Effects Found in Animals Following Oral Exposure to 1,1,2-Trichloroethane          | 4  |
| 1-3. | Summary of Sensitive Targets of 1,1,2-Trichloroethane – Inhalation                        | 8  |
| 1-4. | Summary of Sensitive Targets of 1,1,2-Trichloroethane – Oral                              | 9  |
| 2-1. | Overview of the Number of Studies Examining 1,1,2-Trichloroethane Health Effects          | 12 |
| 2-2. | Levels of Significant Exposure to 1,1,2-Trichloroethane – Inhalation                      | 16 |
| 2-3. | Levels of Significant Exposure to 1,1,2-Trichloroethane – Oral                            | 24 |
| 3-1. | Proposed Metabolic Pathway of 1,1,2-Trichloroethane                                       | 54 |
| 5-1. | Number of NPL Sites with 1,1,2-Trichloroethane Contamination                              | 64 |
| 5-1. | Summary of Existing Health Effects Studies on 1,1,2-Trichloroethane By Route and Endpoint | 85 |

# LIST OF TABLES

| 1-1. | Minimal Risk Levels (MRLs) for 1,1,2-Trichloroethane  | 8  |
|------|---|----|
| 2-1. | Levels of Significant Exposure to 1,1,2-Trichloroethane – Inhalation  | 13 |
| 2-2. | Levels of Significant Exposure to 1,1,2-Trichloroethane – Oral  | 18 |
| 2-3. | Levels of Significant Exposure to 1,1,2-Trichloroethane – Dermal  | 29 |
| 2-4. | Genotoxicity of 1,1,2-Trichloroethane In Vivo   | 48 |
| 2-5. | Genotoxicity of 1,1,2-Trichloroethane In Vitro  | 48 |
| 4-1. | Chemical Identity of 1,1,2-Trichloroethane  | 62 |
| 4-2. | Physical and Chemical Properties of 1,1,2-Trichloroethane   | 62 |
| 5-1. | Facilities that Produce, Process, or Use 1,1,2-Trichloroethane  | 67 |
| 5-2. | Estimated Emissions of 1,1,2-Trichloroethane  | 68 |
| 5-3. | Releases to the Environment from Facilities that Produce, Process, or Use 1,1,2-Trichloroethane                               | 70 |
| 5-4. | Lowest Limit of Detection Based on Standards  | 76 |
| 5-5. | Summary of Environmental Levels of 1,1,2-Trichloroethane  | 76 |
| 5-6. | 1,1,2-Trichloroethane Levels in Water, Soil, and Air of National Priorities List (NPL) Sites                                  | 77 |
| 5-7. | Summary of Annual Concentration of 1,1,2-Trichloroethane (ppbv) Measured in Ambient Air at Locations Across the United States | 77 |
| 7-1. | Regulations and Guidelines Applicable to 1,1,2-Trichloroethane  | 91 |