

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR 2,2-DICHLOROPROPIONIC ACID

INTRODUCTION

This guideline summarizes pertinent information about 2,2-dichloropropionic acid for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Structure



• Synonyms

Alatex; Basfapon; BH Dalapon; Basinex; Crisapon; Dalapon; Dalapon 85; Ded-Weed; Devipon; a-dichloropropionic acid; Dowpon; Dowpon M; Gramevin; Kenapon; Liropon; Proprop; Radapon; Revenge; Unipon

• Identifiers

1. CAS No.: 75-99-0
2. RTECS No.: UF0690000

3. DOT UN: 1760 60

4. DOT label: Corrosive

• Appearance and odor

2,2-Dichloropropionic acid is a corrosive, colorless liquid with an acrid odor. The commercial herbicide is a white or tan powder from the sodium and/or magnesium salt. The odor threshold for 2,2-dichloropropionic acid is reported to be 2,500 mg/m³ (416 ppm).

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 142.97
2. Boiling point (760 mm Hg): 185° to 190°C (365° to 374°F)
3. Specific gravity (water = 1): 1.4 at 20°C (68°F)
4. Vapor density: 4.93
5. Melting point: 174° to 176°C (345.2° to 348.8°F)
6. Vapor pressure: 10 mm Hg at 40°C (104°F)
7. Solubility: Very soluble in water, alcohol, and ether.
8. Evaporation rate: Data not available

• Reactivity

1. Conditions contributing to instability: Heat, sparks, and open flame.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health
Education and Information Division

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

2. Incompatibilities: None reported
3. Hazardous decomposition products: Toxic gases (such as chlorine) may be released in a fire involving 2,2-dichloropropionic acid.
4. Special precautions: 2,2-Dichloropropionic acid is corrosive to iron, aluminum, and copper.

- **Flammability**

The National Fire Protection Association has not issued a fire hazard rating for 2,2-dichloropropionic acid; this substance is not flammable but may burn.

1. Flash point: Not applicable
2. Autoignition temperature: Not applicable
3. Flammable limits in air: Not applicable
4. Extinguishant: Use dry chemical, regular foam, or carbon dioxide to fight fires involving 2,2-dichloropropionic acid. Water may be ineffective, but it may be used to cool fire-exposed containers.

Fires involving 2,2-dichloropropionic acid should be fought upwind from the maximum distance possible. Isolate the hazard area and deny access to unnecessary personnel. Emergency personnel should stay out of low areas and ventilate closed spaces before entering. Vapor explosion and poison hazards may occur indoors, outdoors, or in sewers. Containers of 2,2-dichloropropionic acid may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. If this is not possible, cool containers from the sides with water until well after the fire is out. Stay away from the ends of containers. Dikes should be used to contain fire-control water for later disposal. If a tank car or truck is involved in a fire, personnel should isolate an area of a half a mile in all directions. Firefighters should wear a full set of protective clothing and self-contained breathing apparatus when fighting fires involving 2,2-dichloropropionic acid. Structural firefighters' protective clothing may provide limited protection against fires involving 2,2-dichloropropionic acid.

EXPOSURE LIMITS

- **OSHA PEL**

The Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure

limit (PEL) for 2,2-dichloropropionic acid [29 CFR 1910.1000, Table Z-1].

- **NIOSH REL**

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 1 ppm (6 mg/m³) as a TWA for up to a 10-hr workday and a 40-hr workweek for 2,2-dichloropropionic acid [NIOSH 1992].

- **ACGIH TLV**

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned 2,2-dichloropropionic acid a threshold limit value (TLV) of 1 ppm (5.8 mg/m³) as a TWA for a normal 8-hr workday and a 40-hr workweek [ACGIH 1993].

- **Rationale for limits**

The NIOSH limit is based on the risk of skin, eye, respiratory, and gastrointestinal irritation associated with 2,2-dichloropropionic acid exposure [NIOSH 1992].

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Exposure to 2,2-dichloropropionic acid can occur through inhalation, ingestion, and eye or skin contact; absorption through the skin is said to be "negligible."

- **Summary of toxicology**

1. *Effects on Animals:* Exposure to 2,2-dichloropropionic acid in liquid or vapor form causes corrosion of the eyes and skin; chronic exposure may cause kidney injury. Applied to the skin of rabbits, the sodium salt of 2,2-dichloropropionic acid caused necrosis, and instillation of this substance into the eyes of rabbits caused reversible conjunctival irritation [ACGIH 1991]. The oral LD₅₀ in rats is >5,000 mg/kg [NIOSH 1994]. The oral LD₅₀ in rats for sodium 2,2-dichloropropionic acid is 9,330 mg/kg (male) and 7,570 mg/kg (female) [Farm Chemicals Handbook 1994]. Exposure to an atmosphere saturated with 2,2-dichloropropionic acid for 7 hours produced no observable effects in rats [ACGIH 1991]. Rats fed 15 mg/kg/day of this substance for 120 days had no ill effects [ACGIH 1991]. Dogs fed 100 mg/kg/day of 2,2-dichloropropionic acid for 1 year and rats given 50 mg/kg/day for the same period showed increased

kidney weights at autopsy [ACGIH 1991]. Dogs given 50 mg/kg/day for 1 year or rats given 15 mg/kg/day for 2 years, showed no significant changes at autopsy [ACGIH 1991].

2. *Effects on Humans:* Exposure to 2,2-dichloropropionic acid causes irritation of the eyes, respiratory tract, and skin, and contact of the eyes or skin with the liquid or vapor can lead to burns. Repeated or prolonged skin contact may cause dermatitis [NJDH 1989]. Exposure to a 2- to 7 ppm concentration of this substance for an unspecified time produced respiratory irritation described as "minimal" [ACGIH 1991], and systemic poisoning caused by acute exposure to an unspecified concentration of this substance resulted in lassitude, vomiting, diarrhea, slowed pulse, and anorexia [NLM 1994].

• **Signs and symptoms of exposure**

1. *Acute exposure:* The signs and symptoms of acute exposure to 2,2-dichloropropionic acid include redness and inflammation of the eyes and eyelids, runny nose, sore throat, coughing, sneezing, difficulty breathing, and reddened and cracked skin. Lassitude, anorexia, vomiting, and diarrhea have also been reported. In contact with the eyes or skin, the vapor or liquid of this substance may cause eye or skin burns.

2. *Chronic exposure:* The signs and symptoms of repeated or prolonged skin exposure to 2,2-dichloropropionic acid include reddened, cracked, and blistered skin. Long-term high exposure to 2,2-dichloropropionic acid may affect the liver and kidneys.

• **Emergency procedures**

WARNING!

Transport victims immediately to emergency medical facility!

Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Immediately initiate the following emergency procedures, continuing them as appropriate en route to the emergency medical facility:

1. *Eye exposure:* Tissue destruction and blindness may result from exposure to concentrated solutions, vapors, mists, or aerosols of 2,2-dichloropropionic

acid! *Immediately but gently* flush the eyes with large amounts of water for at least 15 min, occasionally lifting the upper and lower eyelids.

2. *Skin exposure:* Severe burns and skin corrosion may result! *Immediately* remove all contaminated clothing! *Immediately, continuously, and gently* wash skin for at least 15 min. Use soap and water if skin is intact; use only water if skin is not intact.

3. *Inhalation exposure:* Move the victim to fresh air *immediately*.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if 2,2-dichloropropionic acid or any material containing it is ingested:

—Do *not* induce vomiting.

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water. Immediately after rinsing, have the victim drink one cup (8 oz) of fluid and *no more*.

—Do *not* permit the victim to drink milk or carbonated beverages!

—Do *not* permit the victim to drink any fluid if more than 60 min have passed since initial ingestion.

NOTE: These instructions must be followed exactly. Drinking a carbonated beverage or more than one cup of fluid could create enough pressure to perforate already damaged stomach tissue. The tissue-coating action of milk can sometimes impede medical assessment of tissue damage. Ingestion of any fluid more than 60 min after initial exposure could further weaken damaged tissue and result in perforation.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures, the location and proper use of emergency equipment, and methods of protecting themselves during rescue operations.

EXPOSURE SOURCES AND CONTROL METHODS

The following operation may involve 2,2-dichloropropionic acid and lead to worker exposures to this substance:

—Use as a herbicide

The following methods are effective in controlling worker exposures to 2,2-dichloropropionic acid, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information on control methods are as follows:

1. ACGIH [1992]. *Industrial ventilation—a manual of recommended practice*. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. Burton DJ [1986]. *Industrial ventilation—a self study companion*. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
3. Alden JL, Kane JM [1982]. *Design of industrial ventilation systems*. New York, NY: Industrial Press, Inc.
4. Wadden RA, Scheff PA [1987]. *Engineering design for control of workplace hazards*. New York, NY: McGraw-Hill.
5. Plog BA [1988]. *Fundamentals of industrial hygiene*. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveillance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt

immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

• Preplacement medical evaluation

Before a worker is placed in a job with a potential for exposure to 2,2-dichloropropionic acid, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the respiratory system, skin, liver, and kidneys. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society (ATS) [ATS 1987].

A preplacement medical evaluation is recommended to assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to 2,2-dichloropropionic acid at or below the prescribed exposure limit. The health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history of skin allergies or findings consistent with diseases of the respiratory system, skin, liver, or kidneys.

• Periodic medical examinations and biological monitoring

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to 2,2-dichloropropionic acid exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of 2,2-dichloropropionic acid on the

respiratory system, skin, liver, or kidneys. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for 2,2-dichloropropionic acid.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination to determine the worker's medical status at the end of his or her employment. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

WORKPLACE MONITORING AND MEASUREMENT

Determination of a worker's exposure to airborne 2,2-dichloropropionic acid is made using a silica gel tube (150/75 mg sections; 20/40 mesh). Samples are collected at a maximum flow rate of 0.2 liter/min until a maximum air volume of 10 liters is collected. The sample is then treated with deionized water to extract the 2,2-dichloropropionic acid. Analysis is conducted by high performance liquid chromatography using ultraviolet detection. This method is described in the OSHA Computerized Information System [OSHA 1993].

PERSONAL HYGIENE

2,2-Dichloropropionic acid is corrosive; therefore, if this substance contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 minutes, and then wash with soap and water.

Clothing contaminated with 2,2-dichloropropionic acid should be removed immediately, and provisions should be made for the safe removal of the chemical from the clothing. Persons laundering the clothes should be informed of the hazardous properties of 2,2-dichloropropionic acid, particularly its potential to cause burns of the skin on contact.

A worker who handles 2,2-dichloropropionic acid should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, using toilet facilities, or applying cosmetics.

Workers should not eat, drink, use tobacco products, or apply cosmetics in areas where 2,2-dichloropropionic acid or a solution containing 2,2-dichloropropionic acid is handled, processed, or stored.

STORAGE

2,2-Dichloropropionic acid should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of 2,2-dichloropropionic acid should be protected from physical damage and should be stored separately from aluminum and ferric compounds. Because containers that formerly contained 2,2-dichloropropionic acid may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving 2,2-dichloropropionic acid, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup has been completed. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate the area of the spill or leak.
5. For small dry spills, use a clean shovel and gently place the material into a clean, dry container, creating as little dust as possible; cover and remove the container from the spill area.
6. For small liquid spills, take up with sand or other noncombustible absorbent material and place into closed containers for later disposal.
7. For large liquid spills, build dikes far ahead of the spill to contain the 2,2-dichloropropionic acid for later reclamation or disposal.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

- **Emergency planning requirements**

2,2-Dichloropropionic acid is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

- **Reportable quantity requirements for hazardous releases**

A hazardous substance release is defined by EPA as any spilling, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of containers) of hazardous substances. In the event of a release that is above the reportable quantity for that chemical, employers are required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the proper Federal authorities.

The reportable quantity for 2,2-dichloropropionic acid is 5,000 lb. If an amount equal to or greater than this quantity is released within a 24-hr period in a manner that will expose persons outside the facility, employers are required to do the following:

—Notify the National Response Center *immediately* at (800) 424-8802 or at (202) 426-2675 in Washington, D.C. [40 CFR 302.6].

—Notify the emergency response commission of the State likely to be affected by the release [40 CFR 355.40].

—Notify the community emergency coordinator of the local emergency planning committee (or relevant local emergency response personnel) of any area likely to be affected by the release [40 CFR 355.40].

- **Community right-to-know requirements**

Employers are not required by Section 313 of SARA to submit a Toxic Chemical Release Inventory form

(Form R) to EPA reporting the amount of 2,2-dichloropropionic acid emitted or released from their facility annually.

- **Hazardous waste management requirements**

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity, as defined in 40 CFR 261.21-261.24. Although 2,2-dichloropropionic acid is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [40 USC 6901 et seq.], EPA requires employers to treat any waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

- **Conditions for respirator use**

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of 2,2-dichloropropionic acid exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

- **Respiratory protection program**

Employers should institute a complete respiratory pro-

tection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information about the selection and use of respirators and about the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective gloves and clothing should be worn to prevent any skin contact with 2,2-dichloropropionic acid. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. No reports have been published on the resistance of various protective clothing materials to 2,2-dichloropropionic acid permeation. If permeability data are not readily available, protective clothing manufacturers should be requested to provide information on the best chemical protective clothing for workers to wear when they are exposed to 2,2-dichloropropionic acid.

If 2,2-dichloropropionic acid is dissolved in water or an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which 2,2-dichloropropionic acid might contact the eyes (e.g., through splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with 2,2-dichloropropionic acid. Contact lenses should not be worn if the potential exists for 2,2-dichloropropionic acid exposure.

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