

# OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR CAPTAN

## INTRODUCTION

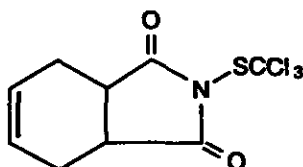
This guideline summarizes pertinent information about captan for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether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

N-trichloromethylthio-4-cyclohexene-1,2-dicarboximide; 3a,4,7,7a-tetrahydro-2-[(trichloromethyl)thio]-1H-isoindole-1,3(2H)-dione; AA Captan; Agrosol S; Agrox 2-Way and 3-Way; Americide; Bangton; Bean Seed Protectant; Captaf; Captex; Esso Fungicide 406;

Flit 406; Glyodex 37-22; Hexacap; Isotox Seed Treater "D" and "F"; Kaptan; Malipur; Merpan; Neracid; Orthocide; Vancide P-75; Vanicide

### • Identifiers

1. CAS No.: 133-06-2
2. RTECS No.: GW5075000
3. DOT UN: 9099 31
4. DOT label: None

### • Appearance and odor

Captan is an odorless, white, crystalline solid that can also be found as a yellow powder. This substance is available as a powder or in a variety of liquid formulations.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 300.57
2. Boiling point (760 mm Hg): Data not available
3. Specific gravity (water = 1): 1.74 at 20°C (68°F)
4. Vapor density: Not applicable
5. Melting point: 178°C (352.4°F) (decomposes)

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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

6 Vapor pressure at 25°C (77°F): Less than 0.00001 mm Hg

7. Solubility: Practically insoluble in water; soluble in acetone, benzene, chloroform, cyclohexanone, isopropanol, and xylene; insoluble in petroleum oils.

8. Evaporation rate: Not applicable

#### Reactivity

1. Conditions contributing to instability: Heat and alkalinity

2. Incompatibilities: Tetraethyl pyrophosphate and emulsifiable concentrate formulations of parathion

3. Hazardous decomposition products: Toxic gases (such as chlorine, phosgene, and oxides of nitrogen and sulfur) may be released in a fire involving captan.

4. Special precautions: Captan cannot be used with strong alkalis or with oil sprays.

#### Flammability

The National Fire Protection Association has not assigned a flammability rating to captan; this substance may burn, but it does not ignite readily.

1. Flash point: Data not available

2. Autoignition temperature: Data not available

3. Flammable limits in air: Data not available

4. Extinguisher: Use dry chemical, carbon dioxide, water spray, or alcohol foam.

Fires involving captan 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. Containers of captan may explode in the heat of the fire and should be moved from the fire area if it is possible to do so safely. Dikes should be used to contain fire-control water for later disposal. Firefighters should wear a full set of protective clothing and self-contained breathing apparatus when fighting fires involving captan. Structural firefighters' protective clothing may provide limited protection against fires involving captan.

## EXPOSURE LIMITS

### • OSHA PEL

The Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure limit (PEL) for captan [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 5 mg/m<sup>3</sup> as a TWA for up to a 10-hr workday and a 40-hr workweek. However, captan has been designated as a potential occupational carcinogen and exposure should be limited to the lowest feasible concentration [NIOSH 1992].

### • ACGIH TLV

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned captan a threshold limit value (TLV) of 5 mg/m<sup>3</sup> 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 potential for cancer that is associated with exposure to captan [NIOSH 1992].

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Exposure to captan can occur through inhalation, ingestion, and eye and skin contact.

### • Summary of toxicology

1. *Effects on Animals:* In animals, captan is an irritant and sensitizer of the skin. When applied to the skin of experimental animals (species not identified) at a dose of 900 mg/kg, captan caused slight irritation [ACGIH 1991], while previously exposed guinea pigs developed a moderate degree of sensitization when rechallenged [Clayton and Clayton 1981]. The dermal LD<sub>50</sub> in rabbits is greater than 9 g/kg [Clayton and Clayton 1981]. The 2-hr LC<sub>50</sub>s for male and female mice are 4,500 and 5,000 mg captan/m<sup>3</sup>, respectively [ACGIH 1991]. However, mechanical

milling of that technical material reduced the 2-hr LC<sub>50</sub>s in mice to 1,700 and 3,700 mg/m<sup>3</sup>, respectively. Estimated inhalation absorption levels for the milled material were calculated to be 142 mg/kg for the males and 310 mg/kg for the females. The 2-hr LC<sub>50</sub> for rats is greater than 5,700 mg/m<sup>3</sup> for unmilled captan [Stevens et al. 1978]. The lowest reported oral LD50s in mice and rats are 7,500 and 8,400 mg/kg [ACGIH 1991; IARC 1983]. Laboratory animals given very high doses (not further specified) of captan became hypothermic, irritable, anorectic, and listless; they also had hyporeflexia and oliguria [EPA 1989]. When tested in mice, rats, dogs, and monkeys at doses below those that are maternally toxic, captan failed to produce teratogenic effects by the oral, subcutaneous, or inhalation route of administration [Hayes 1982]. Although captan has not been shown to be teratogenic, feeding at maternally toxic doses has caused fetotoxicity (increased resorptions and decreased fetal weights) and possible terata (e.g., shortened forelimbs, cleft palate, fused ribs, exencephaly) among the offspring of some species [NLM 1991; IARC 1983]. Feeding studies demonstrated no effects in dogs fed 100 mg/kg/day for 66 weeks, but feeding at a dose of 300 mg/kg/day caused a slight increase in liver and kidney weights [Hayes 1982; ACGIH 1991]. Female rats fed 1,000 or 5,000 ppm captan in their diet (about 250 mg/kg/day) for 2 yr showed growth retardation; at twice this dose, captan caused growth depression in animals of both sexes and testicular atrophy in the males [Clayton and Clayton 1981; Hayes 1982]. Captan is mutagenic in direct contact with susceptible cells, but it is not mutagenic in intact animals, except perhaps at very high doses [Hayes 1982]. Captan was tested for carcinogenicity in mice and rats by dietary administration; it was carcinogenic in one strain of mice, in which it caused a statistically significant increase in the incidence of duodenal tumors [IARC 1983]. The International Agency for Research on Cancer (IARC) has concluded that there is limited evidence that captan is carcinogenic in experimental animals [IARC 1983]. Subsequent to the IARC review, rats and mice that were administered captan in their diets for 80 weeks developed neoplasms, including cancers. Rats developed neoplasms of the ovary, liver, and the pituitary, adrenal, and mammary glands. Mice had increased numbers of duodenal neoplasms [NLM 1991].

2. *Effects on Humans:* In humans, captan is an irritant of the eyes, skin, and upper respiratory tract and a skin sensitizer [Hayes 1982; Klaassen et al. 1986; Clayton

and Clayton 1981]. Skin contact with captan has caused severe sensitivity in some workers, and an estimated 3% to 5% of the exposed population could become sensitized [IARC 1983]. An 18-year-old gardener was confirmed as having recurrent urticaria from exposure to captan [NLM 1991]. A 1,071 mg/kg dose of captan caused the death of one individual [NIOSH 1991].

- **Signs and symptoms of exposure**

1. *Acute exposure:* Captan can induce redness, pain, and tearing of the eyes; runny nose; scratchy throat; difficult breathing; and redness, itching, and cracking of the skin.
2. *Chronic exposure:* Captan-sensitized workers can develop redness, raised areas, blistering, and itching of the skin.

- **Emergency procedures**

**WARNING!**  
**Seek immediate medical attention for severely affected victims or for victims with signs and symptoms of toxicity or irritation!**

Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Irritation may result. **Immediately and thoroughly** flush the eyes with large amounts of water, occasionally lifting the upper and lower eyelids.
2. *Skin exposure:* Irritation may result. **Immediately and thoroughly** wash contaminated skin with soap and water.
3. *Inhalation exposure:* Move the victim to fresh air **immediately**. Have victim blow his or her nose, or use a soft tissue to remove particulates or residues from the nostrils.

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 captan or any material containing it is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do *not* force an unconscious or convulsing person to drink fluid or to vomit.

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 and the location and proper use of emergency equipment.

## EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve captan and may result in worker exposures to this substance:

—Manufacture and formulation of captan-containing fungicides and bactericides

—Use as a fungicide to control scab, black root, botrytis, sooty blotch, and summer rots on apples and for control of a wide variety of fungal diseases on small fruits, berries, vegetables, and ornamental crops

—Use as a bacteriostat in soaps

—Use as a fungicide in paints, lacquers, paper, rubber stabilizers, vinyl resins, plastics, leather fabrics, and to preserve cosmetics and fruits

—Use as a bacteriostat and fungicide in veterinary medicine

The following methods are effective in controlling worker exposures to captan, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about 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 captan, 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 tract and skin. Medical monitoring for respiratory disease should be conducted using the principles and methods recommended by the American Thoracic Society [ATS 1987].

A preplacement medical evaluation is recommended to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to captan at or below the prescribed exposure limit. The licensed 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 allergies and other findings consistent with diseases of the respiratory tract or skin.

- **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 captan exposure. The interviews, examinations, and medical screening tests should focus on identifying the adverse effects of captan on the respiratory tract or skin. 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 captan.

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

The medical, environmental, and occupational history interviews, the physical examination, and selected phys-

ologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

## **WORKPLACE MONITORING AND MEASUREMENT**

A worker's exposure to airborne captan is determined by using an OSHA Versatile Sample (OVS-2) with a 13-mm XAD-2 tube (270/140-mg sections, 20/60 mesh) with glass fiber filter enclosed. Samples are collected at a maximum flow rate of 1.0 liter/min until a maximum air volume of 60 liters is collected. Analysis is conducted by high performance liquid chromatography using an ultraviolet detector. This method is included in the *OSHA Chemical Information Manual* [OSHA 1987].

## **PERSONAL HYGIENE**

If captan contacts the skin, workers should flush the affected areas immediately with plenty of water for 15 min, and then wash with soap and water.

Clothing contaminated with captan should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering the clothes should be informed of the hazardous properties of captan, particularly its potential to cause skin sensitization.

A worker who handles captan 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 captan or a solution containing captan is handled, processed, or stored.

## **STORAGE**

Captan 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 captan should be protected from physical damage and should be stored separately from water and heat. Because containers that formerly contained captan may still hold product residues, they should be handled appropriately.

## SPILLS AND LEAKS

In the event of a spill or leak involving captan, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate potentially explosive atmospheres.
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, absorb with sand or other non-combustible 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 captan 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

Captan 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 contaminated 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 captan is 10 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 who own or operate facilities in SIC codes 20 to 39, who employ 10 or more workers, and who manufacture 25,000 lb or more or otherwise use 10,000 lb or more of captan per calendar year are required by EPA [49 CFR 372.30] to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of captan 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 captan is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [42 USC 6901 et seq.], EPA requires employers to treat 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 captan 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 protection 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 on the selection and use of respirators and on 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 clothing should be worn to prevent skin contact with captan. 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 captan 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 captan.

If captan is dissolved in 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 captan might contact the eyes (e.g., through dust particles or 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 captan. Contact lenses should not be worn if the potential exists for captan exposure.

## REFERENCES CITED

- ACGIH [1991]. Documentation of the threshold limit values and biological exposure indices. 6th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
- ACGIH [1993]. 1993-1994 Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
- ATS [1987]. Standardization of spirometry—1987 update. American Thoracic Society. *Am Rev Respir Dis* 136:1285-1296.
- Clayton G, Clayton F [1981]. *Patty's industrial hygiene and toxicology*. 3rd rev. ed. New York, NY: John Wiley & Sons.
- CFR. Code of Federal regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register.

EPA [1989]. Recognition and management of pesticidal poisonings. 4th ed. Washington, D.C.: U.S. Environmental Protection Agency.

Hayes WJ, Jr. [1982]. Pesticides studied in man. Baltimore, MD: Williams & Wilkins.

IARC [1983]. IARC monographs on the evaluation of carcinogenic risk of chemicals to humans. Vol. 30. Lyon, France: World Health Organization, International Agency for Research on Cancer.

Klaassen CD, Amdur MO, Doull J [1986]. Casarett and Doull's toxicology. 3rd ed. New York, NY: Macmillan Publishing Company.

NIOSH [1987a]. NIOSH guide to industrial respiratory protection. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-116.

NIOSH [1987b]. NIOSH respirator decision logic. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 87-108.

NIOSH [1991]. Registry of toxic effects of chemical substances database: captan. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Division of Standards Development and Technology Transfer, Technical Information Branch.

NIOSH [1992]. NIOSH recommendations for occupational safety and health: compendium of policy documents and statements. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 92-100.

NLM [1991]. The hazardous substances data bank: captan. Bethesda, MD: National Library of Medicine.

OSHA [1987]. Chemical information manual. Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration.

Stevens JT, Farmer JD, Dipasquale LC [1978]. The acute inhalation toxicity of technical captan and folpet. In: Abstracts of Papers for the Seventeenth Annual Meeting of the Society of Toxicology, San Francisco, CA: March 12-16, 1978. Toxicol Appl Pharmacol 45(1):320.