

Material Safety Data Sheet

Lewisite

Date: 16 April 1988

Revised: 4 October 1999

In the event of an emergency
Telephone the SBCCOM Operations
Center's 24-hour emergency
Number 410-436-2148

Section I - General Information

Manufacturer's Address:

U S Army Soldier & Biological Chemical Command (SBCCOM)
Edgewood Chemical Biological Center (ECBC)
ATTN AMSSB-RCB-RS
Aberdeen Proving Ground, MD 21010-5424

CAS Registry Number: 541-25-3

Chemical Name: Dichloro- (2-chlorovinyl) arsine

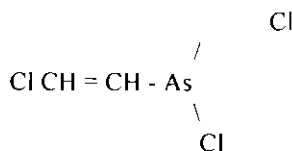
Trade name and synonyms:

Arsine, (2-chlorovinyl) dichloro-
Arsonous dichloride, (2-chloroethenyl)
Chlorovinylarsine dichloride
2-Chlorovinyl dichloroarsine
Beta-Chlorovinyl dichloroarsine
Lewisite
L
EA 1034

Chemical Family: Arsenical (vesicant)

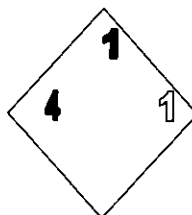
Formula/Chemical Structure:

$C_2 H_2 As Cl_3$



NFPA 704 Signal

Health - 4
Flammability - 1
Reactivity - 1



Section II - Ingredients

Ingredients/Name: Lewisite

Percentage by Weight: 100%

Threshold Limit Value (TLV): 0.003 mg/m³ (This is a ceiling value)

Section III - Physical Data

Boiling Point °F (°C): Calculated 374 °F (190 °C)

Vapor Pressure (mm Hg): 0.22 @ 20 °C
0.35 @ 25 °C

Vapor Density (Air=1): 7.1

Solubility (g/100g solvent): Insoluble in water and dilute mineral acids. Soluble in organic solvents, oils and alcohol.

Specific Gravity (H₂O=1): 1.891 @ 20 °C

Freezing/Melting Point (°C): -18.2 to 0.1 (Depending on purity)

Liquid Density (g/mL): 1.888 @ 20 °C

Volatility (mg/m³): 2,500 @ 20 °C

Viscosity (CENTIPOISE): 2.257 @ 20 °C

Molecular Weight (g/mol): 207.32

Appearance And Odor: Pure Lewisite is a colorless oily liquid, and is amber to dark brown in color. A characteristic odor is usually geranium-like, very little odor when pure.

Section IV - Fire and Explosion Data

Flashpoint: Does not flash

Flammability Limits (% by volume): Not Applicable

Extinguishing Media: Water, fog, foam, CO₂. Avoid use of extinguishing methods that will cause splashing or spreading of L.

Special Fire Fighting Procedures: All persons not engaged in extinguishing the fire should be immediately evacuated from the area. Fires involving L should be contained to prevent contamination to uncontrolled areas. When responding to a fire alarm in buildings or areas containing agents, fire-fighting personnel should wear full firefighter protective clothing (flame resistant) during chemical agent fire-fighting and fire rescue operations. Respiratory protection is required. Positive pressure, full facepiece, NIOSH-approved self-contained breathing apparatus (SCBA) will be worn where there is danger of oxygen deficiency and when directed by the fire chief or chemical accident/incident (CAI) operations officer. In cases where firefighters are responding to a chemical

accident/incident for rescue/reconnaissance purposes they will wear appropriate levels of protective clothing (See Section VIII)

Do not breathe fumes. Skin contact with nerve agents must be avoided at all times. Although the fire may destroy most of the agent, care must still be taken to assure the agent or contaminated liquids do not further contaminate other areas or sewers. Contact with the agent liquid or vapor can be fatal.

Unusual Fire and Explosion Hazards: None known

Section V - Health Hazard Data

Airborne Exposure Limit (AEL): The permissible airborne exposure concentration of L for an 8-hour workday or a 40-hour workweek is an 8-hour time weighted average (TWA) of 0.003 mg/m³ as a ceiling value. A ceiling value may not be exceeded at anytime. The ceiling value for Lewisite is based upon the present technologically feasible detection limits of 0.003 mg/m³. This value can be found in "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard H, HD, and HT." To date, however, the Occupational Safety and Health Administration (OSHA) has not promulgated permissible exposure concentration for L.

Effects Of Overexposure: L is a vesicant (blister agent), also, it acts as a systemic poison, causing pulmonary edema, diarrhea, restlessness, weakness, subnormal temperature, and low blood pressure. In order of severity and appearance of symptoms, it is a blister agent, a toxic lung irritant, absorbed in tissues, and a systemic poison. When inhaled in high concentrations, L may be fatal in as short a time as 10 minutes. L is not detoxified by the body. Common routes of entry into the body are ocular, percutaneous, and inhalation.

Lewisite is generally considered a suspect carcinogen because of its arsenic content.

Toxicological Data:

Man:

LCt50 (inhalation, man) = 1200 - 1500 mg min/m³

LCt50 (skin vapor exposure, man) = 100,000 mg min/m³

LDLO (skin, human) = 20 mg/kg

LCt50 (skin, man) >1500 mg min/m³

L irritates eyes and skin and gives warning of its presence.

Minimum effective dose (ED min) = 200 mg/m³ (30 min)

ICt50 (eyes, man) <300 mg min/m³

Animal:

LD50 (oral, rat) = 50 mg/kg

LD50 (subcutaneous, rat) = 1 mg/kg

LCtLO (inhalation, mouse) = 150 mg/m³ 10m

LD50 (skin, dog) = 15 mg/kg

LD50 (skin, rabbit) = 6 mg/kg

LD50 (subcutaneous, rabbit) = 2 mg/kg

LD50 (intravenous, rabbit) = 2 mg/kg

LD50 (skin, guinea pig) = 12 mg/kg

LD50 (subcutaneous, guinea pig) = 1 mg/kg

LCt50 (inhalation, rat) = 1500 mg min/m³ (9 min)

LD50 (vapor skin, rat) = 20,000 mg min/m³ (25 min)

LD50 (skin, rat) = 15 - 24 mg/kg

LD50 (ip, dog) = 2 mg/kg

Acute Exposure:

Eyes Severe damage Instant pain, conjunctivitis and blepharospasm leading to closure of eyelids, followed by corneal scarring and iritis Mild exposure produces reversible eye damage if decontaminated instantly More permanent injury or blindness is possible within one minute of exposure

Skin Immediate stinging pain increasing in severity with time Erythema (skin reddening) appears within 30 minutes after exposure accompanied by pain with itching and irritation for 24 hours Blisters appear within 12 hours after exposure with more pain that diminishes after 2-3 days Skin burns are much deeper than with HD Tender skin, mucous membrane, and perspiration-covered skin are more sensitive to the effects of L This, however, is counteracted by L's hydrolysis by moisture, producing less vesicant and higher vapor pressure product

Respiratory Tract Irritating to nasal passages and produces a burning sensation followed by profuse nasal secretions and violent sneezing Prolonged exposure causes coughing and production of large quantities of frothy mucus In experimental animals, injury to respiratory tracts, due to vapor exposure is similar to mustards, however, edema of the lung is more marked and frequently accompanied by pleural fluid

Systemic Effects: L on the skin and inhaled vapor, cause systemic poisoning A manifestation of this is a change in capillary permeability, which permits loss of sufficient fluid from the bloodstream to cause hemoconcentration, shock and death In nonfatal cases, hemolysis of erythrocytes has occurred with a resultant hemolytic anemia The excretion of oxidized products into the bile by the liver produces focal necrosis of that organ, necrosis of the mucosa of the biliary passages with periobiliary hemorrhages, and some injury to the intestinal mucosa Acute systematic poisoning from large skin burns causes pulmonary edema, diarrhea restlessness, weakness, subnormal temperature, and low blood pressure in animals

Chronic Exposure Lewisite can cause sensitization and chronic lung impairment

Emergency And First Aid Procedures:

Inhalation: Hold breath until respiratory protective mask is donned Remove from the source **Immediately** If breathing is difficult, administer oxygen If breathing has stopped, give artificial respiration Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available Do not use mouth-to-mouth resuscitation when facial contamination is present Seek medical attention **Immediately**

Eye Contact: Speed in decontaminating the eyes is absolutely essential Remove the person from the liquid source, flush the eyes immediately with water for at least 15 minutes by tilting the head to the side, pulling the eyelids apart with the fingers and pouring water slowly into the eyes Do not cover eyes with bandages but, if necessary, protect eyes by means of dark or opaque goggles Transfer the patient to a medical facility **Immediately**.

Skin Contact: Don respiratory protective mask Remove the victim from agent sources immediately Immediately wash skin and clothes with 5% solution of sodium hypochlorite or liquid household bleach within one minute Cut and remove contaminated clothing, flush contaminated skin area again with 5% sodium hypochlorite solution, then wash contaminated skin area with soap and water Seek medical attention **Immediately**

Ingestion: Do not induce vomiting Give victim milk to drink Seek medical attention **Immediately**.

Section VI - Reactivity Data

Stability: Stable in steel or glass containers at temperatures below 50 °C

Incompatibility: Corrosive to steel at a rate of 1×10^{-5} to 5×10^{-5} in/month at 65 °C

Hazardous Decomposition Products: Reasonably stable, however, in presence of moisture, it hydrolyses rapidly, losing its vesicant property It also hydrolyses in acidic medium to form HCl and non-volatile (solid) chlorovinylarsenious oxide, which is less vesicant than Lewisite Hydrolysis in alkaline medium, as in decontamination with alcoholic caustic or carbonate solution or DS2, produces acetylene and trisodium arsenate

(Na₃ As O₄) Therefore, decontaminated solution would contain toxic arsenic

Hazardous Polymerization: Does not occur

Section VII - Spill, Leak, And Disposal Procedures

Steps To Be Taken In Case Material Is Released Or Spilled: If leaks or spills of L occur only personnel in full protective clothing will be allowed in the area (See Section VIII) See Section V for emergency and first aid instructions

Recommended Field Procedures: Lewisite should be contained using vermiculite, diatomaceous earth, clay, or fine sand and neutralized as soon as possible using copious amounts of alcoholic caustic, carbonate, or Decontaminating Agent (DS2) Caution must be exercised when using these decontaminates since acetylene will be given off Household bleach can also be used if accompanied by stirring to allow contact %) Scoop up all material and place in a DOT approved container Cover the contents with decontaminating solution as above After sealing, the exterior decontaminated and labeled according to EPA and DOT regulations All leaking containers will be over packed with sorbent (e.g. vermiculite) placed between the interior and exterior containers Decontaminate and label according to EPA and DOT regulations Dispose of decontaminate according to Federal, state, and local laws Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (See Sections II and VIII)

Recommended Laboratory Procedures: A 10 wt % alcoholic sodium hydroxide solution is prepared by adding 100 grams of denatured ethanol to 900 grams of 10 wt % NaOH in water A minimum of 200 grams of decon is required for each gram of L The decon and agent solution is agitated for a minimum of one hour At the end of the hour the resulting pH should be checked and adjusted to above 11.5 using additional NaOH, if required It is permitted to substitute 10 wt % alcoholic sodium carbonate made and used in the same ratio as the NaOH listed above Reaction time should be increased to 3-hours with agitation for the first hour Final pH should be adjusted to above 10 Scoop up all material and place in an approved DOT container Cover the contents with decontaminating solution as above The exterior of the container will be decontaminated and labeled according to EPA and DOT regulations All leaking containers will be over packed with sorbent (e.g. vermiculite) placed between the interior and exterior containers Decontaminate and label according to EPA and DOT regulations Dispose of the material in accordance with waste disposal methods provided below Conduct general area monitoring with an approved monitor to confirm that the atmospheric concentrations do not exceed the airborne exposure limits (See Sections II and VIII)

It is permitted to substitute 5.25% sodium hypochlorite for the 10% alcoholic sodium hydroxide solution above Allow one hour with agitation for the reaction Adjustment of the pH is not required Conduct general area monitoring to confirm that the atmospheric concentrations do not exceed the airborne exposure limit (See Section VIII)

Waste Disposal Method: All neutralized material should be collected and contained for disposal according to land ban RCRA regulations or thermally decomposed in an EPA permitted incinerator equipped with a scrubber that will scrub out the chlorides and equipped with an electrostatic precipitator or other filter device and containerize and label according to DOT and EPA regulations The arsenic will be disposed of according to land ban RCRA regulations Any contaminated materials or protective clothing should be decontaminated using alcoholic caustic, carbonates, or bleach analyzed to assure it is free of detectable contamination (3X) level The clothing should then be sealed in plastic bags inside properly labeled drums and held for shipment back to the DA issue point

Note: Some decontaminate solutions are hazardous waste according to RCRA regulations and must be disposed according to those regulations

Section VIII - Special Protection Information

Concentration

< 0.003 mg/m³

Respiratory Protective Equipment

A full face piece, chemical canister air-purifying, protective masks will be on hand for escape. The M-40 series protective masks are acceptable for this use.

> or = 0.003 mg/m³

NIOSH/MSHA approved, full face or unknown piece SCBA suitable for use in high Lewisite concentrations with a protective ensemble (See DA Pam 386-61 for examples)

Ventilation

Local Exhaust: Mandatory. Must be filtered or scrubbed. Air emissions shall meet local, state and federal regulations.

Special: Chemical laboratory hoods will have an average inward face velocity of 100 linear feet per minute (lfpm) +/- 20% with the velocity at any point not deviating from the average face velocity by more than 20%. Existing laboratory hoods will have an inward face velocity of 150 lfpm +/- 20%. Laboratory hoods will be located such that cross drafts do not exceed 20% of the inward face velocity. A visual performance test using smoke producing devices will be performed in assessing the ability of the hood to contain Lewisite.

Other: Recirculation of exhaust air from agent areas is prohibited. No connection between agent area and other areas through the ventilation system is permitted. Emergency backup power is necessary. Hoods should be tested semiannually or after modification or maintenance operations. Operations should be performed 20 centimeters inside hoods.

Protective Gloves: Butyl Rubber gloves M3 and M4
Norton, Chemical Protective Glove Set

Eye Protection: As a minimum, chemical goggles will be worn. For splash hazards use goggles and face shield.

Other Protective Equipment: For laboratory operations, wear lab coats, gloves and have mask readily accessible. In addition, daily clean smocks, foot covers, and head covers will be required when handling contaminated lab animals.

Monitoring: Available monitoring equipment for agent L is the M18A2 (yellow band), bubblers (arsenic and GC method), and M256 and A1 Kits.

Real-time, low-level monitors (with alarm) are required for L operations. In their absence, an Immediately Dangerous to Life and Health (IDLH) atmosphere must be presumed. Laboratory operations conducted in appropriately maintained and alarmed engineering controls require only periodic low-level monitoring.

Section IX - Special Precautions

Precautions To Be Taken In Handling And Storing: When handling agents, the buddy system will be incorporated. No smoking, eating, or drinking in areas containing agents is permitted. Containers should be periodically inspected for leaks, (either visually or using a detector kit). Stringent control over all personnel practices must be exercised. Decontaminating equipment will be conveniently located. Exits must be designed to permit rapid evacuation. Chemical showers, eyewash stations, and personal cleanliness facilities must be provided.

Wash hands before meals and shower thoroughly with special attention given to hair, face, neck, and hands using plenty of soap and water before leaving at the end of the workday

Other Precautions: L should be stored in containers made of glass for Research, Development, Test and Evaluation (RDTE) quantities or one-ton steel containers for large quantities. Agent will be stored in a single containment system within a laboratory hood or in a double containment system

For additional information see "AR 385-61, The Army Toxic Chemical Agent Safety Program," "DA Pam 385-61, Toxic Chemical Agent Safety Standards," and "DA Pam 40-173, Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Mustard Agents H, HD, and HT "

Section X - Transportation Data

Proper Shipping Name: Toxic liquids, n o s

Dot Hazard Class: 6.1, Packing Group I

Dot Label: Poison

Dot Marking: Toxic liquids, n o s Dichloro-(2-chlorovinyl)arsine UN 2810

Dot Placard: Poison

Emergency Accident Precautions And Procedures: See Sections IV, VII and VIII

Precautions To Be Taken In Transportation Motor vehicles will be placarded regardless of quantity. Drivers will be given full information regarding shipment and conditions in case of an emergency. AR 50-6 deals specifically with the shipment of chemical agents. Shipment of agents will be escorted in accordance with AR 740-32

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