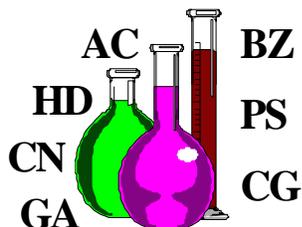


U.S. Army Center for Health Promotion and Preventive Medicine



*Detailed Facts About Blister Agent Nitrogen Mustard
(HN-2)*

218-11-1096

Physical Properties of HN-2

<i>Chemical Structure</i>	$\begin{array}{c} \text{CH}_2\text{CH}_2\text{Cl} \\ \\ \text{H}_3\text{C}-\text{N} \\ \\ \text{CH}_2\text{CH}_2\text{Cl} \end{array}$
<i>Chemical Formula</i>	$(\text{C}_1 \text{CH}_2 \text{CH}_2)_2 \text{N C H}_3$
<i>Description</i>	HN-2 is pale amber to yellow oily liquid; fruity odor in high concentrations; smells like soft soap with a fishy smell in low concentrations.
<i>Molecular Weight</i>	156.07
<i>Vapor Pressure (mm Hg)</i>	0.130 @ 10°C 0.290 @ 20°C 0.427 @ 25°C 1.25 @ 40°C
<i>Boiling Point</i>	75°C
<i>Freezing Point</i>	-65°C to -60°C
<i>Density</i>	Liquid = 1.15 g/cc@20°C Vapor = 5.4 times heavier than air
<i>Solubility</i>	Soluble in acetone and organic solvents and oil; sparingly soluble in water.
<i>Flash Point</i>	No immediate danger of fire or explosion.

Agent HN-2 - Nitrogen Mustard. The chemical 2,2'-Dichloro-N-methyldiethylamine, Chemical Abstract Service Registry No. 51-75-2.

Volatility 1,150 mg/m³ @ 10°C 3,580 mg/m³ @ 25°C

5,100 mg/m³ @ 30°C
10,000 mg/m³ @ 40°C

Toxicity Values

IC_{t50} (eye contact) = 100 mg-min/m³
IC_{t50} (percutaneous vapor) = 9,500 mg-min/m³
LC_{t50} (inhalation) = 3,000 mg-min/m³
NOAEL (inhalation) = 2 mg-min/m³

Exposure Limits

Workplace Time-Weighted Average - No standard identified
General Population Limits - No standard identified

Toxic Properties of HN-2

HN-2, the second of a series of nitrogen mustard compounds developed in the late 1920s and early 1930s, was designed as a military agent which became a pharmaceutical substance called Mustine. The chemical intermediate it produces is used as an antineoplastic drug. These agents are more immediately toxic than the sulfur mustards.

Overexposure Effects

HN-2 is highly irritating to the eyes and throat; in high concentrations it can cause blindness. Absorbed into the bloodstream it will seriously interfere with the functioning of hemoglobin and will eventually damage the endocrine system. HN-2 is a vesicant (blister agent) and alkylating agent producing cytotoxic action on the hematopoietic (blood-forming) tissues which are especially sensitive. HN-2 is not naturally detoxified by the body; therefore, repeated exposure produces a cumulative effect.

Emergency and First Aid Procedures

Inhalation: remove from source immediately; give artificial respiration if breathing has stopped; administer oxygen if breathing is difficult; seek medical attention immediately.

Eye Contact: flush eyes immediately with water for 10-15 minutes, pulling eyelids apart with fingers, and pouring water into eyes; do not cover eyes with bandages; protect eyes with dark or opaque goggles after flushing eyes; seek medical attention immediately.

Skin Contact: don respiratory mask and gloves; remove victim from source immediately and remove contaminated clothing; decontaminate the skin immediately by flushing with a 5 percent solution of liquid household bleach; wash off with soap and water after 3-4 minutes to remove decon agent and protect against erythema; seek medical attention immediately; to prevent systemic toxicity, decontaminate as late as 2 or 3 hours after exposure even if it increases the severity of the local reaction; further clean with soap and water.

Ingestion: do not induce vomiting; give victims milk to drink; seek medical attention immediately.

Protective Equipment

Protective Gloves: MANDATORY - Wear Butyl toxicological agent protective gloves (M3, M4, or glove set).

Eye Protection: Wear chemical goggles as a minimum; use goggles and face shield for splash hazard.

Other: Wear full protective clothing consisting of the M3 Butyl rubber suit with hood, M2A1 boots, M3 gloves, treated underwear, M9 series mask and coveralls (if desired). Wear gloves and lab coat with M9, M17, or M40 mask readily available for general lab work.

In addition, wear daily clean smock, foot covers, and head cover when handling contaminated lab animals.

Reactivity Data

Stability: Not stable; decomposes before boiling point is reached or condenses under all conditions; the reactions involved could generate enough heat to cause an explosion; dry crystals are stable.

Incompatibility: No actions on metals, or other materials.

Hazardous Decomposition: Approximate half-life in water at 25°C is 4 minutes; decomposition point is below boiling point.

Hazardous Polymerization: Polymerized components will present an explosion hazard in open air.

Rate of Hydrolysis: Slow, except in presence of alkalis; products formed are complex polymeric quaternary ammonium salts; dimerizes fairly rapidly in water.

Persistency Depends on munitions used and the weather; somewhat shorter duration of effectiveness for HD, heavily splashed liquid of which persists 1 to 2 days under average weather conditions, and a week or more under very cold conditions.

References

1. Department of the Army Field Manual (DA FM) 3-9, *Potential Military Chemical/Biological Agents and Compounds*, 1990.

2. DA FM 8-285, *Treatment of Chemical Agent Casualties and Conventional Military Chemical Injuries*, 1990.
3. *The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Eleventh Edition*, Merck & Co., Inc., Rahway, New Jersey, 1989.
4. U. S. Army Chemical Command Materiel Destruction Agency, *Site Monitoring Concept Study*, 15 September 1993.

For more information, contact:
Kenneth E. Williams
USACHPPM
Aberdeen Proving Ground, MD 21010-5422
Commercial (410) 671-2208, DSN: 584-2208
email: kwilliam@aeha1.apgea.army.mil

