Sources of Exposure

General Populations

- The general population is not likely to receive exposures to sulfur mustard.
- Populations located near Army bases where sulfur mustard is stored might be exposed through accidental release; however the Army has taken precautions to protect the public against exposure.
- Sulfur mustard, commonly referred to as mustard gas, is primarily used in chemical warfare.
- The use of sulfur mustard by terrorists is of concern.

Occupational Populations

- People who work at Army bases where sulfur mustard is stored may be exposed when handling, transporting, disposing and treating hazardous waste containing sulfur mustard.
- It is possible that workers in plastics manufacturing may be exposed to mustard agents resulting from process contamination with sulfur or nitrogen impurities.
- Fishermen may inadvertently snare lumps of sulfur mustard in their nets in areas where dumping has occurred.
- Soldiers may be exposed to sulfur mustard with its use as a chemical warfare agent.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Sulfur mustard is readily absorbed through the lungs and skin and appears to be widely distributed throughout the body.
- Thiodiglycol appears to be the major sulfur mustard hydrolysis product following inhalation or dermal exposure.
- Urinary excretion is the primary route of elimination for sulfur mustard and its metabolites.
- First-order elimination kinetics were observed in accidentally exposed patients with a half life of thiodiglycol elimination estimated to be 1.2 days.
- There were no toxicokinetic studies available in animals or humans regarding oral exposure.

Normal Human Levels

- No data available.

Biomarkers/Environmental Levels

Biomarkers

- Unmetabolized sulfur mustard may be detected in urine after exposure to very high levels of sulfur mustard.
- High urinary levels of thiodiglycol can be used to identify sulfur mustard exposure but does not definitely prove sulfur mustard poisoning.
- The presence of sulfur-mustard associated adducts may indicate exposure.

Environmental Levels

Air

- Expected to be zero except possibly near military facilities.

Sediment and Soil

- No data are available on current concentrations in soil.

Water

- No data describing concentrations of sulfur mustard where ocean dumping has occurred.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Sulfur Mustard Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

$C_4H_8Cl_2S$

ToxGuide™ for Sulfur Mustard

$C_4H_8Cl_2S$

CAS# 505-60-2

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U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

Contact Information:
Division of Toxicology
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Applied Toxicology Branch

1600 Clifton Road NE, F-62
Atlanta, GA 30333
1-800-CDC-INFO
1-800-232-4636

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Sulfur Mustard is an Oily Liquid

- Sulfur mustard is a viscous liquid at ambient temperature, but can become a vapor at higher temperatures.
- It is heavier than water as a liquid and heavier than air as a vapor.
- Can easily dissolve in fats, oils, alcohol, and gasoline, but dissolves slowly in unstirred water.

Routes of Exposure

- Inhalation (breathing) – Potential route of exposure for general population. An important route of occupational exposure.
- Oral – Potential minor route of exposure via ingestion of contaminated water.
- Dermal (skin) – Potential route of exposure for the general population. Predominant route of occupational exposure.

Sulfur Mustard in the Environment

- Sulfur mustard is not found naturally in the environment in any amount.
- On dry surface soil, volatilization would be the main route of sulfur mustard loss; on wet surface soil, hydrolysis would be the primary loss pathway.
- Sulfur mustard deposited on surface soil will evaporate within 30–50 hours, with its persistence depending on temperature and wind conditions.
- In water, sulfur mustard will volatilize to air, hydrolyze, or remain unchanged.
- Sulfur mustard does not bioconcentrate due to its reactivity.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- An MRL of 0.0007 mg/m^3 has been derived for acute-duration inhalation exposure (≤14 days).
- An MRL of 0.00002 mg/m^3 has been derived for intermediate-duration exposure (15–364 days).
- No MRL was derived for chronic-duration inhalation exposure (≥1 year).

Oral

- An MRL of 0.0005 mg/kg/day has been derived for acute-duration oral exposure (≤14 days).
- An MRL of 0.00007 mg/kg/day has been derived for intermediate-duration oral exposure (≤15–364 days).
- No MRL was derived for chronic-duration oral exposure (≥1 year).

Health Effects

- The primary effects associated with exposure to sulfur mustard are conjunctivitis occurring as early as 30 minutes after exposure, formation of vesicles or blisters on exposed skin beginning several hours after exposure, and respiratory irritation (cough, sore throat, shortness of breath, severe erosions or membranous lesions of tracheobronchial mucosa).
- Reproductive effects, including reduced sperm counts, increased fetal mortality, and altered sex ratios, have been observed in humans exposed to sulfur mustard.
- Sulfur mustard may cause cancer in the respiratory tract and skin of humans.
- DHHS and IARC consider sulfur mustard to be a human carcinogen.

Children's Health

- The onset of symptoms occur sooner in children, with blisters appearing sooner in children than adults.
- Cough and vomiting are the first signs of exposure in children, but not in adults.
- The severity of ocular symptoms and the frequency of respiratory and gastrointestinal symptoms were greater in children than in adults.