

This fact sheet answers the most frequently asked health questions (FAQs) about sulfur mustard. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

**Highlights: The general population is not exposed to sulfur mustard. Sulfur mustard can cause irritation and burns of the skin, eyes, and respiratory tract, reproductive effects, and may cause cancer of the respiratory tract. This chemical has been found in at least 3 of the 1,636 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

#### **What is sulfur mustard?**

Sulfur mustard (HD) is a thick liquid at ambient temperature, but becomes a solid at 58 °F. It is heavier than water as a liquid and heavier than air as a vapor. It does not occur naturally in the environment. It is often called mustard gas, but sulfur mustard is not likely to change into a gas immediately if it is released at ordinary temperatures. As a pure liquid, it is colorless and odorless, but when mixed with other chemicals, it looks brown and has a garlic-like smell.

Sulfur mustard has been used in chemical warfare and was made in large amounts during World Wars I and II. It was reportedly used in the Iran-Iraq war in 1980-1988. It is not presently used in the United States, except for research purposes, and the U.S. Department of Defense must destroy all remaining stocks of sulfur mustard by 2004.

#### **What happens to sulfur mustard when it enters the environment?**

- Sulfur mustard would primarily enter the environment through an accidental release from Army bases where it is stored.
- In soil and water, some sulfur mustard evaporates into the air and the rest breaks down in minutes to days depending on environmental conditions.
- Sulfur mustard reacts with chemicals in the air to form other compounds.
- Sulfur mustard does not move from soil to groundwater, and it does not build up in the tissues of animals because it breaks down quickly.

#### **How might I be exposed to sulfur mustard?**

- Sulfur mustard is no longer made in the United States and is only stored at a few Army storage sites; therefore, the general public is not exposed to sulfur mustard.
- Individuals working at or living near these military storage sites may be exposed to sulfur mustard if there was an accidental spill or unplanned release. However, the Army has taken many precautions to protect the public from exposure to sulfur mustard.
- Occupational exposures are currently limited to soldiers in some combat situations; those involved in its shipment, storage, or disposal; construction workers at storage sites; research laboratories; and workers involved in plastics manufacturing resulting from process contamination with sulfur or nitrogen impurities.

#### **How can sulfur mustard affect my health?**

Sulfur mustard can cause skin burns and blisters, especially around sweaty parts of the body. It is more harmful to the skin on hot, humid days, or in tropical climates. Sulfur mustard makes your eyes burn, your eyelids swell, and causes you to blink a lot. If you breathe sulfur mustard, it can cause coughing, bronchitis, and long-term respiratory disease. Exposure to a large amount of sulfur mustard can cause death. Some men exposed to sulfur mustard during war have experienced lower sperm counts.

#### **How likely is sulfur mustard to cause cancer?**

Studies of people exposed during the production process or during war, as well as animal studies, have shown that sulfur mustard may cause respiratory cancer. The Department of Health and Human Services (DHHS) and the

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International Agency for Research on Cancer (IARC) have determined that sulfur mustard is carcinogenic to humans.

#### **How can sulfur mustard affect children?**

Sulfur mustard causes the eyes and skin of children to burn similarly to adults; however, the burns are more severe and blisters appear sooner in children.

Limited human and animal data indicate that sulfur mustard may cause birth defects or otherwise affect development.

It is not known if sulfur mustard can cross the placenta or be passed to infants in breast milk.

#### **How can families reduce the risk of exposure to sulfur mustard?**

- The risk of exposure to sulfur mustard is generally low, but may be greater for those who live or work near Army bases and facilities that store it. Sulfur mustard is currently being destroyed at these facilities and the risk of exposure due to accidents is minimal.
- Children should avoid playing near uncontrolled hazardous waste sites where sulfur mustard may have been discarded.

#### **Is there a medical test to determine whether I've been exposed to sulfur mustard?**

Sulfur mustard or its breakdown products can be detected in your blood and urine within a few weeks after your last exposure. These tests are not usually available at your doctor's office, but your doctor can send the samples to a laboratory that can perform the tests. None of these tests, however, can predict whether you will experience any health effects.

#### **Has the federal government made recommendations to protect human health?**

The federal government recommends an exposure limit of 0.0002 mg/m<sup>3</sup> for 24 hours/day, 7 days/week to provide adequate protection for the general population for the Chemical Stockpile Demilitarization Program. For the workers the recommendation is 0.0004 mg/m<sup>3</sup> for 8 hours, 5 days/week.

The National Advisory Committee has developed acute exposure guideline levels (AEGs) to protect people from the harmful effects of a short-term (8 hours or less) exposure to sulfur mustard. Three types of AEGs have been developed: AEG-1, AEG-2, and AEG-3. For sulfur mustard, the AEG-1 values range from 0.40 mg/m<sup>3</sup> for a 10-minute exposure to 0.008 mg/m<sup>3</sup> for an 8-hour exposure; exposure to higher concentrations may result in eye irritation. The AEG-2 values range from 0.60 mg/m<sup>3</sup> for 10 minutes to 0.013 mg/m<sup>3</sup> for 8 hours; exposure to higher concentrations may result in swelling of the eyes, sensitivity to light, and eye irritation. The AEG-3 values range from 3.9 mg/m<sup>3</sup> for 10 minutes to 0.27 mg/m<sup>3</sup> for 8 hours; exposure to higher concentrations may result in death.

#### **References**

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

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaqs/index.asp>. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

