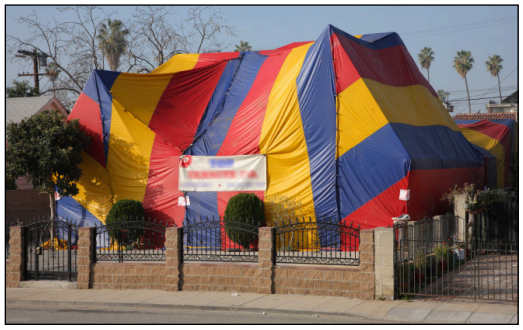
SULFURYL FLUORIDE

general fact sheet

What is sulfuryl fluoride?



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Sulfuryl fluoride is a colorless, odorless gas. It is used to fumigate buildings and some stored agricultural products like grains. Sulfuryl fluoride is used to control a wide range of pests. Some of these include bed bugs, termites, rats, and mice.

What are some products that contain sulfuryl fluoride?

Sulfuryl fluoride has been registered in the United States for use in pesticides since 1959. All sulfuryl fluoride products are restricted use pesticides (RUPs). This means that they can only be legally purchased and used by those who are properly trained and licensed. Some trade names include Vikane®, Zythor®, and Master Fume®.

How does sulfuryl fluoride work?

When sulfuryl fluoride gas is released within a home it spreads out and seeps into cracks and pores. This allows it to reach pests throughout the home, including those found within wall voids and porous materials like wood and fabric. When insects or rodents are exposed to sulfuryl fluoride, it releases fluoride into their bodies. With high enough exposures, their cells stop making energy and eventually they die.

How might I be exposed to sulfuryl fluoride?

After fumigation, those who enter treated buildings may be exposed to very low levels of sulfuryl fluoride in the air. Currently, federal law requires these levels to be below 1 part per million (ppm) before residents can return. That's about the same as ½ of a drop in a bathtub full of water. Licensed professionals must confirm low levels by using air-monitoring devices. The remaining sulfuryl fluoride dissipates over time; an estimated half-loss of about 16 hours has been reported. Half-loss is how long it takes about half the gas to dissipate from the structure.

Those outside a building may also be exposed to low or moderate levels of sulfuryl fluoride. This may happen while a building is treated or when it is aired out afterward. Tenting reduces leaking during the treatment. In two studies, outdoor air levels of sulfuryl fluoride were measured during a treatment. Levels were less than 1 ppm except during the first six hours of treatment and during ventilation afterward. The highest level detected in the air was about 24 ppm. This was 5 feet from the home during ventilation. At 10 feet, the highest level was about 7.5 ppm during ventilation. Levels of sulfuryl fluoride in the outside air were less than 1 ppm after 2 hours of ventilation. Consider the precautions listed on page 3.

IMPORANT: Always ***follow label instructions*** and take steps to ***avoid exposure***. If any exposures occur, be sure to follow the First Aid instructions on the product label carefully. For additional treatment advice, contact the Poison Control Center at 800-222-1222. If you wish to discuss a ***pesticide problem***, please call 1-800-858-7378.

People may also be exposed to low levels of sulfuryl fluoride in their diet. Sulfuryl fluoride is used to fumigate some stored food commodities. It can stick briefly in some oils. When sulfuryl fluoride mixes with proteins in food it can also leave fluoride residues behind. The U.S. Environmental Protection Agency (US EPA) sets legal limits for both sulfuryl fluoride and fluoride on food.

What are some signs and symptoms from a brief exposure to sulfuryl fluoride?

In a 2008 case report, a woman spent about three hours inside a tented building being treated with sulfuryl fluoride. According to the report, she experienced stomach pain, vomiting, difficulty breathing, confusion, low blood pressure, convulsions, low blood calcium levels, an abnormal heart rhythm, and death.

In separate studies, rats, rabbits, and dogs breathed air containing sulfuryl fluoride for two weeks. When air levels were held at 100 ppm, no health effects were observed in any test animals. This level is 100 times higher than what is legally allowed in homes prior to reentry. At 300 ppm, animals had effects such as increased kidney weight, inflammation in the upper airways, tremors, muscle spasms, and brain tissue damage.

Chloropicrin is added as a warning agent to buildings with sulfuryl fluoride. It has a strong odor and can be irritating to the eyes, airways, and skin. Breathing in vapors may also cause vomiting. Chloropicrin dissipates from homes more slowly than sulfuryl fluoride.

What preparations are necessary prior to fumigation?

Pesticide labels require that residents be provided a fact sheet prior to the fumigation of their home. A checklist may also be provided. These materials have information about the preparations that are necessary. Check with the pest control company about additional steps.

Common preparations before a home fumigation:

- Remove all pets (including fish) and plants. The treatment can be harmful to animals or plants if left inside. Special preparations can sometimes be made for fish tanks.
- Turn off pilot lights and other ignition sources. Think about furnaces, stoves, ranges, hot water heaters, gas refrigerators, etc.
- Remove waterproof mattress and pillow covers or open the seals. When this is not possible, remove the mattress or pillow from the building.
- Remove or double bag* food, feed, medications, and tobacco. This includes food stored in refrigerators and freezers. Items that are in rigid plastic, glass, or metal containers with the manufacturer's air tight seal may not need to be removed. *Only special bags provided by the pest control company can be used.
- Remove solutions used to develop photographic film.
- Wet soil around the perimeter of the tented building. This can help prevent fumigant loss through the soil and protect adjacent plants.

What additional precautions can I take?

After your home is cleared for reentry by a professional, consider some additional time to ventilate. You can open windows, cabinets, and refrigerators, turn on air handling systems, squeeze couch cushions, and use fans to speed the removal of any lingering sulfuryl fluoride gas. If your neighbor's home is being treated, consider closing up windows, turning off air conditioners and attic fans, and staying inside during the application and venting period. If your homes are very close to one another, you may optionally leave until after ventilation is complete.

Using sulfuryl fluoride pesticide products properly and legally requires a license, calibrated equipment, and expertise. If you have doubts about a professional, you can:

- Contact your state pesticide regulatory agency. They can verify a pesticide applicator's license. They may also be able to share information about previous violations.
- Contact the pest control company. Consider asking for documentation that verifies that air monitoring devices have been calibrated recently and are working correctly.
- Before entering your home after the fumigation, consider asking what levels of sulfuryl fluoride were detected. Is there a readout that can be shared? By law, air levels must be less than 1 part per million (ppm). You can also ask a potential pest control company if they offer this service before they are hired.

What happens to sulfuryl fluoride when it enters the body?

When breathed in, sulfuryl fluoride is rapidly absorbed into the body. There, it breaks down into sulfate, fluoride, and fluorosulfate. These components move in the blood stream to many parts of the body. Collectively, these include the lungs, kidney, spleen, nasal tissues, and brain.

Sulfate and fluorosulfate leave the body in urine rapidly; half-lives of between one and four hours have been reported. In one study, fluoride levels in urine increased quickly after exposure. However, these levels returned to normal after about 12 to 24 hours. Above a certain daily dose, fluoride levels can build up in bones and teeth.

Is sulfuryl fluoride likely to contribute to the development of cancer?

Sulfuryl fluoride is classified by the EPA as not likely to cause cancer in humans. In long-term studies, animals breathed in high concentrations (80 ppm) of sulfuryl fluoride six hours per day, five days a week for more than a year. There was no evidence that exposure led to the development of cancer. Other studies found that sulfuryl fluoride does not alter or damage genes.

Has anyone studied non-cancer effects from long-term exposure to sulfuryl fluoride?

In several studies, rats, mice, rabbits, and dogs breathed air with several different levels of sulfuryl fluoride for three months. When air levels were at 30 ppm or less, no health effects were observed in any animal. This level is 30 times higher than what is legally allowed in homes prior to reentry. At higher

levels, effects such as inflamed airways, discolored teeth, inactivity, drooling, tremors, muscle spams, incoordination, and brain damage were observed.

In similar studies, rats and dogs breathed air with sulfuryl fluoride for one to two years. There were no effects to dogs when air levels were at 20 parts per million (ppm). At this same level, some rats had discolored teeth but no other effects.

Scientists have also researched developmental and reproductive effects in rats and rabbits. In these studies, animals breathed air with several different levels of sulfuryl fluoride during their pregnancies. For animals in the womb, no health problems were observed when air levels were at or below 75 ppm. Rats born from mothers who were exposed over the course of their lives did not have health effects at or below 20 ppm. At higher doses, newborn rats had lower body weights and liver effects. No effects to mating or fertility were observed at any dose.

What happens to sulfuryl fluoride in the environment?

When released, sulfuryl fluoride rapidly spreads out through the air and into the atmosphere. Its lifetime in the atmosphere is estimated to be 4.5 years or more. After a single emission, this is the average amount of time it would take to return to pre-release levels of sulfuryl fluoride in the atmosphere. Over time, ocean water pulls it from the air. However, sulfuryl fluoride is not readily taken up by clouds, rain, fresh water, or land-based plants. In water, sulfuryl fluoride is rapidly broken down; half-lives of about 10 minutes to 3 days have been reported.

Evidence suggests that sulfuryl fluoride can act as a greenhouse gas. However, it is practically non-reactive in the atmosphere. So, it is not expected to destroy ozone. Sulfuryl fluoride has replaced many uses of methyl bromide. Methyl bromide is classified as a "Class I Ozone Depleting Substance" by the EPA.

Can sulfuryl fluoride affect birds, fish, or other wildlife?

Sulfuryl fluoride is highly toxic to fish and water fleas. It is low in toxicity to wild mammals if inhaled at expected exposure levels. There are no direct studies that test its toxicity to birds or honey bees. The EPA estimates that sulfuryl fluoride is highly toxic to honey bees.

Sulfuryl fluoride released from homes rapidly spreads out in the air. So, contact with sulfuryl fluoride at high levels for long periods of time is unlikely. However, the highest risk for wildlife is during early application and ventilation near the perimeter of a treated home.

To reduce risk to wildlife, you might consider relocating feeders, bird baths, and other items that may attract wildlife near your home. If you have beehives next to your home, you may also consider relocating your hives until after ventilation.

Where can I get more information?

For more detailed information please visit the list of referenced resources, call NPIC between 8:00 AM and 12:00 PM Pacific Time (11:00 AM to 3:00 PM Eastern Time), Monday - Friday, at 800-858-7378, or visit us on the web at npic.orst.edu. NPIC provides objective, science-based answers to questions about pesticides.

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