

# 2

Treatment Manual

## Chemical Treatments

### *Fumigants • Sulfuryl Fluoride*

---

#### Contents

Properties and Use	page-2-9-1
Leak Detection	page-2-9-2
Tarpaulin Fumigation	page-2-9-2
Sealing	page-2-9-2
Circulation	page-2-9-3
Prevention of Condensation	page-2-9-3
Gas Sampling Lines	page-2-9-3
Gas Introduction	page-2-9-4
Dosage Rate	page-2-9-5
Measure Gas Concentrations	page-2-9-5
Replacing Lost Gas	page-2-9-5
Aeration	page-2-9-5
Structural Fumigation	page-2-9-6
Chamber Fumigation	page-2-9-6
Shipboard Fumigation	page-2-9-6
Safety and First Aid	page-2-9-7
Protective Clothing	page-2-9-7
If SF Is Inhaled	page-2-9-7
If Liquid SF Is Spilled on the Skin	page-2-9-7
If Liquid SF Is in the Eyes	page-2-9-7

Consult the Vikane<sup>1</sup> Gas Fumigant label and Structural Fumigation Manual for more detailed instructions and additional supportive information.

---

#### Properties and Use

Sulfuryl fluoride (SF) is a compressed-gas fumigant which is used primarily against insects that attack wood. The following characteristics make this fumigant especially desirable:

- ◆ 2.88 times heavier than air
- ◆ High vapor pressure — 13,442 mm Hg @ 770°F
- ◆ Low solubility in water and low sorption by soil or commodity
- ◆ Odorless, colorless, and nonflammable
- ◆ Penetrates wood better than any other commercial fumigants, including methyl bromide
- ◆ Relatively nonreactive

---

<sup>1</sup> Trademark of Dow Agro Sciences

◆ Very low loss through plastic tarpaulins

SF boils at minus 67°F. SF is not registered for use on foodstuffs or on living plant material.

SF is effective at very low dosages on Drywood termites where control of the adult stage is the only concern (typically 0.5 to 1.0 lbs/1,000<sup>2</sup>). Higher dosages are required for control of the egg stage of other insects (typically 3 to 5 lbs/1,000<sup>2</sup>). Consult treatment schedules in this manual for specific dosages.

---

## Leak Detection

Interscan (Model GF 1900) or Miran gas analyzers (these units are portable) may be used to detect SF in the range of 0 to 150 ppm respectively. Consult the Vikane Structural Fumigation Manual for further instructions. Colorimetric (“detector”) tubes are not available for detecting SF gas leaks around tarpaulins, chambers, and application equipment.

---

## Tarpaulin Fumigation



Refer to the section for tarpaulin fumigation with methyl bromide for additional information on the following:

- selecting fumigation sites
- placing gas sampling lines
- sealing tarpaulins
- taking concentration readings
- securing fumigation areas



Refer to the PPO Treatment Manual section on [Fumigants • Methyl Bromide • Tarpaulin Fumigation](#) on [page 2-4-1](#) (and aeration), the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures.

### Sealing

The commodity to be fumigated should be placed onto a relatively even and non-porous surface, such as concrete, asphalt, or macadam. Special attention should be given to the seal along the ground or floor. The inspector should have tape, sand, or water snakes properly positioned.

### Circulation

Fans are necessary to distribute SF and to help prevent condensation. The number of fans depends upon the cubic volume of the enclosure being treated, and the arrangement of cargo. Axial fans of approximately 5,000 cfm have proven effective. Usually 2 fans are used, one on either end facing the lower center and upper center of the load. If the enclosure is over 35 feet long, additional fans should be used. It is usually not necessary to run fans longer than 15 minutes after the gas has been introduced.

### Prevention of Condensation

In cool weather, moisture may condense under tarpaulins if the sun is shining directly on the load. Continuous air circulation can prevent this from occurring. Do not tarp or seal any item while it is wet.

### Gas Sampling Lines

A thermal conductivity unit calibrated for Vikane must be available for readings. Sampling lines should be arranged so that gas samples are drawn from representative parts of the fumigation area and lead to a common point.

A minimum of 3 sampling lines should be placed in enclosures of up to 10,000 ft<sup>3</sup> at the following locations:

- ◆ Front of the load, 3 inches from the floor
- ◆ Center of the load, midway from the bottom to the top of the load
- ◆ Rear of the load, at the top.

When 10,000 to 15,000 ft<sup>3</sup> are being treated, 2 additional lines should be appropriately deployed.

## Gas Introduction

Unlike methyl bromide, SF does not require the use of a volatilizer to speed up its conversion from a liquid to a gas. The gas introduction tube should be placed directly in the air flow of a fan away from the cargo. Also, place a drip cloth under the tube. The introduction rate is controlled by the introduction line length and diameter. A 1/8 inch inside diameter by 100 ft long hose will allow a flow rate of approximately 2 lbs per minute while a 25 ft long hose will allow approximately 4 lbs per minute.

**TABLE 2-0-30: Effect of Hose Inside Diameter on Rate of Gas Introduction through a 25 Foot Hose**

Inside Diameter (in inches)	Pounds Vikane Per Minute
1/8	4
1/4	20
1/2	45

Approximate; dependent on pressure in cylinder.

**TABLE 2-9-1: Effect of Hose Length on Rate of Gas Introduction through a 1/8 inch Inside Diameter Hose**

Hose Length (in feet)	Pounds Vikane Per Minute
25 ft	4.0
50 ft	2.8
100 ft	2.0 <sup>1</sup>

<sup>1</sup> Where fumigant introduction rates lower than 2 lbs/min are needed, a longer hose can be used, e.g., 200 ft.

It is important not to overshoot the ability of the fan to rapidly disperse the cool air near the fumigant introduction site. Fan capacity should be at least 1,000 cfm for each lb of Vikane introduced per minute. In addition, a volatilizer (heat exchanger) may be used in fumigating containers or small chambers to prevent a “fog-out” (condensation) which could cause corrosion or damage to the contents. The last few pounds of fumigant will turn to gas within the cylinder before moving out, and the flow rate will be reduced. The cylinder and tubing will often become frosted. Be certain that no open flame or glowing hot surfaces above 400°C are present since corrosive substances (mainly hydrofluoric acid) are formed when SF is exposed to such conditions. To avoid possible damage, do not apply the fumigant directly to any surface.

## Dosage Rate

To control a particular pest, locate the proper fumigation schedule to be followed in the Treatment Manual. The three variables in these schedules are temperature, dosage, and exposure duration. Treatment is not recommended below 50°F. Dosages are in pounds per 1,000 feet<sup>3</sup> of space. To determine the total amount of fumigant required by weight in pounds, divide the total volume of space by 1,000. Then multiply the resulting figure by the dosage rate schedule expressed in pounds (per 1,000 feet<sup>3</sup>). The cylinder should be placed on a scale, and the flow of gas is controlled by the valve and introduction line until the desired cylinder end-weight is obtained. The valve should be turned fully open to fill the fumigant introduction hose with liquid SF. Initially, the valve should be opened slightly until flow has begun and then opened about one full turn which should give full flow through the 1/8" fumigant introduction hose.

## Measure Gas Concentrations

During the course of fumigation, minimum concentrations must be maintained according to the schedules used. Readings on the T/C unit (Fumiscope or Gow-Mac) if not calibrated for Vikane must be multiplied by a factor to obtain the actual ounces per 1,000 feet<sup>3</sup> present. Contact the Center for Plant Health Science & Technology (CPHST) in Raleigh, North Carolina, for calibration information. Be certain that the reading without the multiplied factor is also registered on PPQ Form 429, however. Do not use filters containing sodium hydroxide (Ascarite) with SF. Fresh desiccant (Drierite) should be used with the T/C unit. Desiccant should be changed at appropriate intervals to insure accurate readings.

## Replacing Lost Gas

When it appears that additional SF will be needed, the inspector should use his best judgment to determine the amount of gas to add, according to the prevailing conditions of tarpaulin tightness or wind conditions. Usually, 1.6 oz of gas should be added for every ounce of deficiency in the minimum concentration required.

## Aeration

For detailed guidelines, consult the "Aeration" discussion elsewhere in this manual, [Fumigants • Methyl Bromide • Tarpaulin Fumigation](#) on [page 2-4-1](#), the Vikane Gas Fumigant label, and Structural Fumigation Manual. The threshold limit value for SF is 5 ppm (20 mg/cubic meter), the same as for MB. Since no colorimetric ("detector") tubes are available for SF, a suitable instrument must be used, such as the Interscan GF 1900 or Miran (calibrated for SF).

## Structural Fumigation

Refer to the section on MB structural fumigation (or aeration) in this manual, the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures.

When preparing a structure for fumigation with SF, the surrounding soil should be watered thoroughly at the base of trees, shrubs, and other ornamental plants around the perimeter of the structure to prevent loss of fumigant into the soil. Watering around the plants will protect the roots; however, plants and grass closer than 1 ft may die even if this precaution is taken.

Before placing the tarpaulin over the structure, be sure to remove items for which the use of SF is not registered. These include food, feed, drugs, and medicines. Extinguish all flames (including pilot lights), unplug all heating elements, and turn off all lights. Open all internal doors.

---

## Chamber Fumigation

Refer to the section on MB chamber fumigation (and aeration) in this manual, the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures.



Trying to measure out a small quantity of SF in a graduated glass tube (sight gauge)—which is common practice with MB chamber fumigations—should never be attempted with SF because the cylinder pressure is much greater, and the glass gauge may explode and shatter.

The gas will generally be introduced through a volatilizer or heat exchanger in order to prevent a “fog-out” which could damage the contents. Introducing a very small amount of gas into a small chamber, however, is difficult to do with precise accuracy because the amount introduced must be calculated by weight loss from the cylinder. The scale used beneath the cylinder must be readable in ounces or grams, not just in pounds or kilograms.

---

## Shipboard Fumigation

Refer to the section on MB ship fumigation (and aeration) in this manual, the Vikane label, and Vikane Structural Fumigation Manual for a detailed discussion of proper procedures. Surface ships (only those in port) must be fumigated at dock side, and not when the vessels are underway. Shipboard fumigation is also regulated by the U.S. Coast Guard (Department of Transportation). That regulation appears as 46CFR 147A.

## Safety and First Aid

Read and understand all directions and safety precautions on Vikane label before applying. Additional information is presented in Vikane Structural Fumigation Manual. There is no known antidote for SF. Vikane is odorless. However, the chance of lethal exposure is not probable unless an individual actually enters the fumigation space. An SCBA must be worn by anyone in the fumigated areas when the level exceeds 5 ppm.

### Protective Clothing

Wear goggles or full face shield for eye protection during introduction of the fumigant. Do not wear gloves or rubber boots. Do not reuse clothing or shoes that have become contaminated with liquid SF until thoroughly aerated and cleaned.

### If SF Is Inhaled

An individual who has inhaled high concentrations of SF may exhibit the following symptoms:

- ◆ Difficulty breathing
- ◆ Dulled awareness
- ◆ Nausea
- ◆ Numbness in the extremities
- ◆ Slowed body movements
- ◆ Slowed or garbled speech

If any of the above symptoms appear, immediately do the following:

- ◆ Remove the victim to fresh air
- ◆ Put victim at complete rest
- ◆ Keep the victim warm and see that breathing is normal and unhampered; if breathing has stopped, give artificial respiration
- ◆ Do not give anything by mouth to an unconscious person
- ◆ Obtain medical assistance

### If Liquid SF Is Spilled on the Skin

Immediately apply water to the contaminated area of clothing before removing. Wash contaminated skin thoroughly or shower.

### If Liquid SF Is in the Eyes

Flush with plenty of water for at least 20 minutes, and get medical attention. Damage to the eye may result from cold or freezing temperatures.

