



# SOIL FUMIGANT SOLUTION

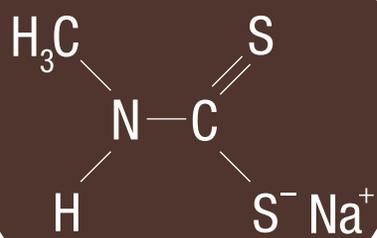


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VAPAM (metam sodium) is a very effective soil fumigant for the suppression and/or control of nematodes, soil-borne diseases, insects, weeds and germinating weed seeds.

**VAPAM® HL™** metam sodium is a very effective soil fumigant that has been and continues to be a critical tool used to suppress and/or control nematodes, soil-borne diseases, soil-borne insects, weeds and germinating weed seeds and tubers.

VAPAM can be applied using solid set sprinklers, linear movable sprinklers, drip irrigation, soil drench, spray blades, shank injection and power tillers.

VAPAM, in combination with Telone® and/or chloropicrin, is a viable alternative to methyl bromide, and can be applied commercially to prepare the soil prior to establishing various tree crops (fruit, nut, citrus), or planting vegetables, row crops or ornamental plants. Properly applied according to label directions, these VAPAM combinations can successfully control a broad variety of soil pests. Proper application is the key to success.

VAPAM is registered as a soil fumigant for almost all crops.

## Pests Suppressed and/or Controlled With VAPAM

### Nematodes

All species are susceptible when proper contact is achieved.

### Diseases

VAPAM can control or suppress:

***Rhizoctonia***

***Pythium***

***Phytophthora***

***Sclerotinia***

***Oak Root Fungus***

***Fusarium*<sup>1</sup>**

Active, respiring forms of these pathogens are more susceptible and therefore more easily controlled. Resting forms, such as sclerotia, are more difficult to control.

### Weeds

Weed seeds must be respiring in order to be controlled. Germination is not required for control to be achieved. Some seed coats are difficult to penetrate and may result in poor control unless the seeds are actively growing or the seed coat has been scarified and good contact is achieved. Contact with the foliage and roots usually controls emerged, actively growing plants.

<sup>1</sup> As diseases evolve over time, it is very important to not only know the disease, but the particular isolate in a given crop. For instance, K-PAM is effective in controlling or suppressing many *Fusarium* species (*Fusarium* sp.), but *Fusarium oxysporum* f.sp. *radicis-lycopersici* has proven to be very difficult to control with VAPAM or other soil fumigants. Check with your PCA or University Extension Plant Pathologist for specific recommendations.

# GENERAL INSTRUCTIONS

Prior to application, consult label<sup>1</sup> and complete all requirements pertaining to the use of VAPAM. These include, but are not limited to:

**Certified Applicator Training Requirements (both registrant-provided and state-required)**

**Buffer Zones**

**Buffer Zone Sign Posting**

**Buffer Zone Credits**

**Buffer Zone Monitoring or Neighbor Notification**

**Buffer Overlap Restrictions**

**Buffer Zone Structures and Areas**

**Buffer Zone Distances**

**Difficult to Evacuate Facility Requirements**

**Additions to Fumigant Management Plan (FMP) to Capture the Above**

See the label for detailed instructions on these and other subjects.

## Certified Applicator Training

Any certified applicator supervising a soil fumigant application must have successfully completed one of the soil fumigant training programs listed on the EPA website (<http://www.epa.gov/fumigantraining>) for the active ingredient in this product. The training must be completed in the time frames listed on the website. The FMP must document the date and location where the soil fumigant training program was completed.

<sup>1</sup> EPA approved Phase II label dated Dec. 27, 2011.



## Buffer Zones

A buffer zone must be established for every fumigant application.

General buffer zone requirements:

- > An area established around the perimeter of each application block. The buffer zone must extend outward from the edge of the application block perimeter equally in all directions.
- > All non-handlers, including field workers, residents, pedestrians, and other bystanders, must be excluded from the buffer zone during the buffer zone period except for transit (see Buffer Zone Exemptions for Transit on Roadways, p. 5).
  - Local, state, or federal officials performing inspection, sampling, or other similar official duties are not excluded from the application block or the buffer zone by this labeling. The certified applicator supervising the application and the owner of the establishment where the application is taking place are not authorized to, or responsible for, excluding those officials from the application block or the buffer zone.
- > The buffer zone period begins at the start of the application and lasts for a minimum of 48 hours after the application is complete.

See the label for additional buffer zone information.

## Buffer Zone Sign Posting

- > Posting of a buffer zone is required unless there is a physical barrier that prevents bystander access to the buffer zone.
- > Buffer zone signs must be placed along or outside the perimeter of the buffer zone, at all usual points of entry and along likely routes of approach from areas where people not under the owner's control may approach the buffer zone.

**Exception: If multiple contiguous blocks are fumigated within a 14-day period, the entire periphery of the contiguous blocks' buffer zones may be posted. Buffer zone signs must be posted no sooner than 24 hours prior to the start of the first application. The signs must remain posted until the last buffer zone period expires and signs must be removed within three days after the buffer zone period for the last block has expired.**

See label for full details.



CONTROLS  
or  
SUPPRESSES  
**NEMATODES**  
**DISEASES**  
**WEEDS**

## Buffer Zones (cont.)

### Buffer Zone Credits

The buffer zone distances for VAPAM applications may be reduced by the percentages listed below. Credits may be added, but credits cannot exceed 80%. The minimum buffer zone distance is 25 feet regardless of buffer zone credits available.

- > See [www.tarpcredits.epa.gov](http://www.tarpcredits.epa.gov) for a list of tarps that have been tested and determined to qualify for buffer reduction credits. Only tarps listed on this website qualify for buffer reduction credits.
- > 10% reduction in buffer zone distance IF the organic content of the soil in the application block is less than 1%, up to 2%; a 20% reduction in buffer zone distance IF the organic content of the soil in the application block is between 2% to 3%; and a 30% reduction in the buffer zone distance IF the organic content of the soil in the application block is greater than 3%.
- > 10% reduction in buffer zone distance IF the soil temperature is measured to be 50°F or less. Measure and record temperature at the application depth or 12 inches, whichever is shallower.
- > 10% reduction in the buffer zone distance, IF the clay content of the soil in the application block is greater than 27%.
- > Consult local regulations and the label when determining buffer zone credits.

### Buffer Zone Monitoring or Neighbor Notification

Fumigant Site Monitoring is **ONLY** required if the Emergency Preparedness and Response Measures are triggered AND directions from the Response Information for Neighbors section are not followed (see label).

From the start of the application until the buffer zone period expires, a certified applicator or handler(s) under applicator supervision must:

- > Monitor for sensory irritation (tearing, burning of the eyes or nose) in areas between the buffer zone outer perimeter and residences and businesses that trigger this requirement.
- > Begin sensory irritation monitoring in the evening on the day of application and continue until the buffer zone period expires.
- > Monitor a minimum of eight times during the buffer zone period, including these time periods:
  - One hour before sunset
  - During the night
  - One hour after sunrise
  - During daylight hours

Implement the emergency response plan immediately if a handler monitoring experiences sensory irritation.

### Buffer Overlap Restrictions

Before the start of application, the certified applicator must determine whether their buffer zone will overlap any metam sodium or metam potassium (or other MITC-generating pesticides) buffer zone(s).

To reduce the potential for off-site movement from multiple fumigated fields, buffer zones from multiple metam sodium or metam potassium (or other MITC-generating pesticides) application blocks must not overlap UNLESS:

- 1. A minimum of 12 hours have elapsed from the time the earlier application(s) is complete until the start of the later application, and**
- 2. Fumigant Site Monitoring or Response Information for Neighbors has been implemented if there are any residences or businesses within 300 feet of any of the buffer zones.**

Additionally, for low release height-solid stream center pivot applications, before application begins, the certified applicator must determine whether the application block, or its resulting buffer, will overlap with a buffer that is already in effect.

To reduce the potential for off-site movement from multiple fumigated fields, buffer zones from multiple metam sodium or metam potassium application blocks may not overlap UNLESS:

- 1. Both application blocks are treated using low release height-solid stream center pivot systems. The 12-hour waiting period does not apply in this instance\*, and**
- 2. Emergency preparedness and response measures specified in the label have been implemented if there are any homes, businesses, or property not within the control of the fumigator within 300 feet of each buffer zone.**

\*NOTE: Under this exception, buffer zones may only overlap with those from application blocks that are not within the same field (i.e., application blocks must be in separate fields that are treated with a different center pivot rig also equipped with low release height, etc.). For buffers from application blocks within the same field to overlap, 12 hours must elapse from the completion of the first application until the start of the subsequent application.

### Structures Under the Control of the Owner of the Application Block

Buffer zones must not include buildings used for storage (e.g., sheds, barns, garages), UNLESS:

- 1. The storage buildings are not occupied during the buffer zone period, and**
- 2. The storage buildings do not share a common wall with an occupied structure.**

## Areas Not Under the Control of the Owner of the Application Block

Buffer zones must not include residential areas (e.g., employee housing, private property), buildings (e.g., commercial, industrial), outdoor residential areas (e.g., lawns, gardens, play areas) and other areas that people may occupy, UNLESS:

- 1. The occupants provide written agreement prior to the start of the application, that they will voluntarily vacate the buffer zone during the entire buffer zone period, and**
- 2. Reentry by occupants and other non-handlers must not occur until**
  - The buffer zone period has ended.
  - Sensory irritation (tearing, burning of the eyes or nose) is not experienced upon re-entry.

Buffer zones must not include agricultural areas owned and/or operated by persons other than the owner of the application block, UNLESS:

- 1. The owner of the application block can ensure that the buffer zone will not overlap with a metam sodium or metam potassium (or other MITC-generating pesticides) buffer zone from any other property owners, except as provided in the Buffer Zone Proximity section, and**
- 2. The owner of the other property provides written agreement to the applicator that they, their employees, and other persons will stay out of the buffer zone during the entire buffer zone period.**

Buffer zones must not include roadways and rights of way UNLESS:

- 1. The area is not occupied during the buffer zone period, and**
- 2. Entry by non-handlers is prohibited during the buffer zone period.**

## Buffer Zone Exemptions for Transit on Roadways

- 1. Vehicular and bicycle traffic on public and private roadways through the buffer zone is permitted.**
- 2. Buffer zones are not permitted to include bus stops or other locations where persons wait for public transit.**

See label for full list.

Certified applicators must comply with all local laws and regulations.

See the posting section on label for additional requirements that may apply.

## Buffer Zone Distances

Buffer zone distances must be calculated using the application rate and the size of the application block.

- > Buffer zone distances must be based on lookup tables in this labeling (25 feet is the minimum distance regardless of site-specific application parameters).
- > If after applying all applicable buffer zone credits the buffer zone is greater than 1/2 mile (2,640 feet), then the application is prohibited.
- > Tables in the label according to the method of application must be used to determine the minimum buffer distances. Round up to the nearest rate and block size, where applicable. Applications are prohibited for rates or block sizes that exceed what is presented in the buffer zone tables.

## Difficult to Evacuate Facility Requirements

Difficult to evacuate sites include:

- > Pre-K to grade 12 schools
- > State-licensed day care centers
- > Nursing homes
- > Assisted living facilities
- > Hospitals
- > In-patient clinics
- > Prisons
- > No fumigant application with a buffer zone greater than 300 feet is permitted within 1/4 mile (1,320 feet) of difficult to evacuate sites unless the site is not occupied by children from state-licensed day care centers, students (pre-K to grade 12), patients or prisoners during the application and the 36-hour period following the end of the application.
- > No fumigant application with a buffer zone of 300 feet or less is permitted within 1/8 mile (660 feet) of difficult to evacuate sites unless the site is not occupied by children from state-licensed day care centers, students (pre-K to grade 12), patients or prisoners during the application and the 36-hour period following the end of the application.

## Site-Specific Fumigation Management Plan (FMP)

Prior to the start of application, the certified applicator supervising the application must verify that a site-specific FMP exists for each application block. In addition, an agricultural operation fumigating multiple application blocks may format the FMP in a manner whereby all of the information that is common to all the application blocks is captured once, and any information unique to a particular application block or blocks is captured in subsequent sections.

The FMP must be prepared by the certified applicator, the site owner, registrant, or other party.

The certified applicator must verify in writing (sign and date) that the site-specific FMP(s) reflects current site conditions before the start of application.

See the label for details of the site-specific FMP.

### Emergency Response Plan

The certified applicator must include in the FMP a written emergency response plan that identifies:

- > Evacuation routes
- > Locations of telephones
- > Contact information for first responders and local/state/federal/tribal personnel
- > Emergency procedures/responsibilities (e.g., adding water to the field, repairing tarps, fixing equipment, evacuating upwind) if:
  - there is an incident
  - sensory irritation (tearing, burning of the eyes or nose) is experienced outside of the buffer zone
  - there are equipment/tarp/seal failure or complaints
  - other emergencies

### Record-Keeping Procedures

The owner of the application block as well as the certified applicator supervising the application must keep a signed copy of the site-specific FMP for two years from the date of application.

For situations where an initial FMP is developed and certain elements do not change for multiple application blocks (e.g., applicator information, certified applicator, handlers, record-keeping procedures, emergency procedures), only elements that have changed need to be updated in the site-specific FMP provided the following:

- > The certified applicator supervising the application has verified that those elements are current and applicable to the application block before it is fumigated.
- > Record-keeping requirements are followed for the entire FMP (including elements that do not change).
- > The certified applicator must make a copy of the FMP immediately available for viewing by handlers involved in the fumigation.
- > The certified applicator or the owner of the application block must provide a copy of the FMP to any local/state/federal/tribal enforcement personnel who request the FMP. In the case of an emergency, the FMP must be made immediately available when requested by local/state/federal/tribal emergency response and enforcement personnel.
- > The certified applicator supervising the application must ensure the FMP is at the application block during all handler activities.
- > Within 30 days after the application is complete, the certified applicator supervising the application must complete a Post-Application Summary.

The FMP must be prepared by the certified applicator, the site owner, registrant, or other party.



# APPLICATION INSTRUCTIONS

## Soil Conditions

**Before applying VAPAM, always thoroughly cultivate the area to be treated, breaking up clods and loosening the soil to facilitate the uniform distribution of VAPAM.**

Proper moisture in the field is essential for optimum activity of VAPAM. Soil moisture must be 60% to 80% of available water capacity. In areas where soil moisture must exceed available water capacity to form a bed (e.g., certain regions of Florida), soil moisture content may exceed 80%.

Field conditions such as soil type, soil temperature, soil structure, organic matter content and mineral makeup of soil directly impact the mobility and conversion of metam sodium to MITC, and hence the performance of the product.

## Field Monitoring

### During Application

For all applications, except water run, from the start of the application until the application is complete, a certified applicator must be at the application block in the line of sight of the application and must directly supervise all persons performing handling activities.

For water-run applications (e.g., sprinkler/chemigation, wheel line, center pivot, lateral move, drip, flood, etc.):

- > A certified applicator must be in the line of sight of the application at the start of the application, including setup, calibration, and initiation of the application.
- > A certified applicator may leave but must return at least every two hours to visually inspect the equipment to ensure proper functioning and must directly supervise all Water Protection Standard (WPS)-trained handlers until the application is complete.
- > WPS-trained handlers may perform these monitoring functions in place of a certified applicator, but they must be under the supervision of a certified applicator and be able to communicate with a certified applicator at all times during monitoring activities via cell phone or other means.

<sup>2</sup> **Entry Restricted Period: This period begins at the start of the application and expires five days after the application is complete. If tarps are used, this period ends when tarps are perforated and removed. Entry into the application block during this period is only allowed for appropriately PPE-equipped handlers performing handling tasks.**

## After Application

For handling activities that take place after the application is complete until the entry restricted<sup>2</sup> period expires, the certified applicator is not required to be on site, but must have communicated in a manner that can be understood by the site owner and handlers responsible for carrying out those activities the information necessary to comply with the label and procedures described in the FMP (e.g., emergency response plans and procedures).

See label for complete discussion of monitoring activity including Respiratory Protection and Stop Work Triggers.

For all applications, the certified applicator must monitor the application site for the following conditions:

- 1. Wind conditions**
- 2. Air temperature**
- 3. Soil temperature**
- 4. Presence or absence of odors downwind of the application site**

Monitoring the field should be conducted prior to, during and at the completion of all VAPAM applications. Upon application completion there are two options for monitoring:

- 1. Buffer zone monitoring**
- 2. Neighbor notification**

See VAPAM labels for details.

Always observe best management procedures to minimize off-site movement of odors when applying VAPAM. Always consult local agricultural regulations for specific application requirements.

## For All Applications

### Respiratory Protection and Stop Work Triggers

The following procedures must be followed to determine whether an air-purifying respirator is required or if operations must cease for any person handling a task (except for fumigant site monitoring outside of the buffer zone) as stated in the VAPAM label.

If at any time any handler experiences sensory irritation (tearing, burning of the eyes or nose), then either:

- > An air-purifying respirator must be worn by all handlers who remain in the application block or surrounding buffer zone, or
- > Operations must cease and handlers not wearing an air-purifying respirator must leave the application block and surrounding buffer zone.

Handlers can remove air-purifying respirators or resume operations if two consecutive breathing-zone samples taken at the handling site at least 15 minutes apart show that levels of MITC have decreased to less than 600 ppb (0.6 ppm), provided that handlers do not experience sensory irritation. During the collection of air samples, an air-purifying respirator must be worn by the handler taking the air samples. Samples must be taken at the location where the irritation was first experienced.

When using monitoring devices to monitor air concentration levels, a direct-read detection device, such as an electronic device or a colorimetric device (e.g., Draeger, Sensidyne) must be used. The devices must have sensitivity of at least 600 ppb (0.6 ppm) for MITC. Persons using direct-read detection devices must follow the manufacturer's directions.

When breathing zone samples are required, they must be taken outside respiratory protection equipment and within a 10-inch radius of handler's nose and mouth.

When air-purifying respirators are worn, air-monitoring samples must be collected at least every two hours in the breathing zone of a handler performing a representative handling task.

If at any time (1) a handler experiences sensory irritation when wearing an air-purifying respirator, or (2) a MITC air sample is greater than or equal to 6,000 ppb (6 ppm), then all handler activities must cease and handlers must be removed from the application block and surrounding buffer zone.

Handlers can resume work activities without air-purifying respirators if two consecutive breathing-zone samples taken at the handling site at least 15 minutes apart show levels of MITC have decreased to less than 600 ppb (0.6 ppm), provided that handlers do not experience sensory irritation. During the collection of air samples, an air-purifying respirator must be worn by the handler taking the air samples. Samples must be taken at the location where the irritation was first experienced or where sample(s) were greater than or equal to 6,000 ppb (6 ppm).

Handlers can resume work activities if all of the following conditions exist provided that the appropriate air-purifying respirator is worn:

- > Two consecutive breathing zone samples for MITC taken at the handling site at least 15 minutes apart must be less than 6,000 ppb (6 ppm)
- > Handlers do not experience sensory irritation while wearing an air-purifying respirator and
- > Filter cartridges/canisters have been changed.

During the collection of air samples, an air-purifying respirator must be worn by the handler taking the air samples. Samples must be taken at the location where the irritation was first experienced or where sample(s) were greater than or equal to 6000 ppb (6 ppm).

## Methods of Application

See label for full details.

VAPAM can be applied through various methods and application equipment. A chemigation application through the irrigation system can utilize sprinkler, flood and drip applications. Sprinkler and flood applications provide broadcast coverage using existing equipment for irrigation. The depth and degree of VAPAM movement into the soil is dependent upon soil type, duration of application time and amount of water used for the application.

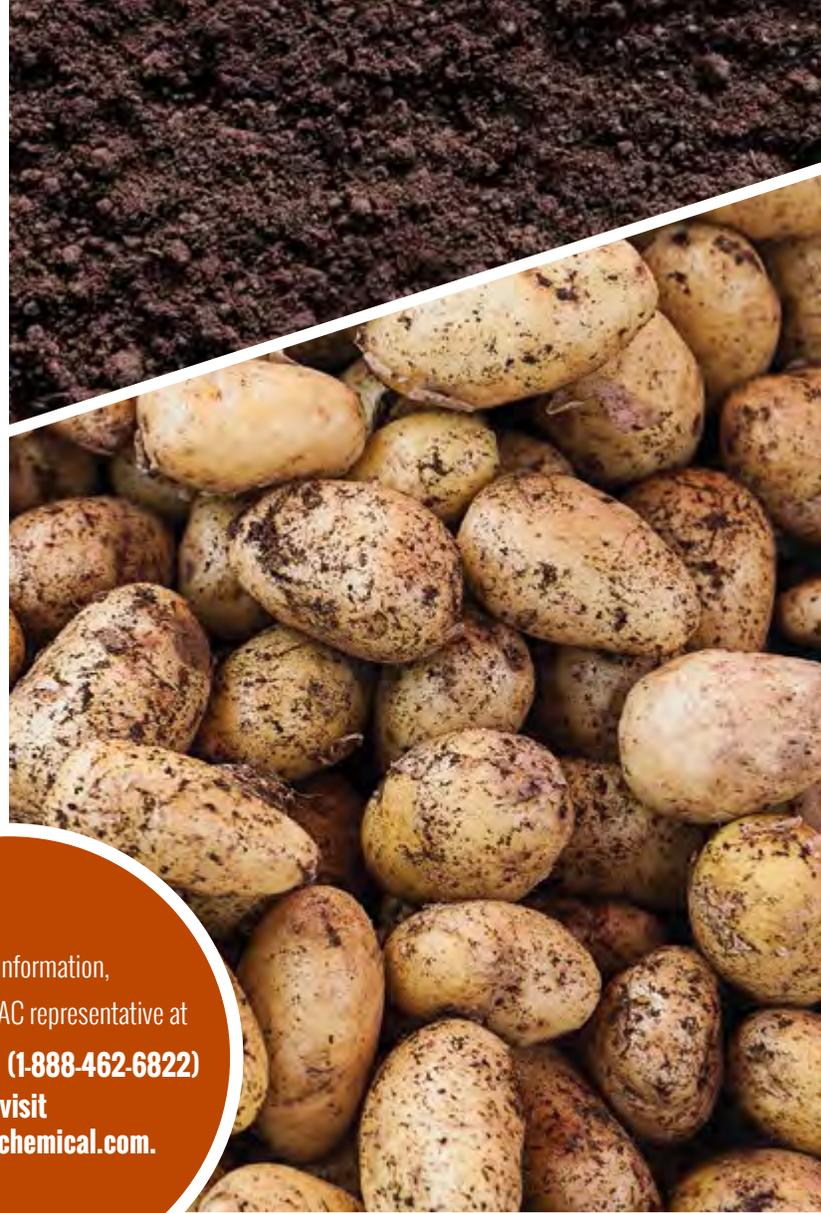
Drip applications can use existing drip lines, or in some situations require an additional drip line to ensure coverage. This form of application places the VAPAM in the crop row seedbed. It can provide excellent protection in the root growing area of the plant. The depth and area of coverage depends on the amount of water and duration of application.

Injection by blade or shanks can place the VAPAM in a band or in several bands vertically and horizontally in the soil. This method provides exact placement, generally targeting specific pests.

Power incorporated applications place the VAPAM in the upper levels of the soil at a homogenized level throughout the treated zone. The placement of the VAPAM is dependent on the depth of incorporation.

## VAPAM Chemigation Guide

1. Pre-application soil moisture should be 60% to 80% of field capacity in the top four to six inches at the time of application (refer to “Hands-On” chart below).
2. The soil should be in good seedbed condition, free of large clods.
3. For optimum results, beds should be listed, shaped and ready for planting.
4. Before working on, repairing, adjusting or calibrating injection equipment, personal protective equipment must be worn by all workers.
5. Make sure all hose connections are secure, sealed and tightened.
6. Inspect that check valves, back flow preventers, vacuum relief valves and low-pressure drains are installed and functioning. Do not allow any chemical to flow into the supply water.
7. Determine that interlocking controls are installed and functioning.
8. Check the irrigation system for leaks.
9. Monitor the field application.
10. Flush irrigation system at the conclusion of the application.



For more information,  
contact your AMVAC representative at  
**1-888 GO AMVAC (1-888-462-6822)**  
or visit  
[www.amvac-chemical.com](http://www.amvac-chemical.com).

### “HANDS-ON” SOIL MOISTURE IDENTIFICATION

% MOISTURE	SAND	SANDY LOAM	CLAY LOAM	CLAY
Close to 0%	Dry, loose, single-grained, flows through fingers	Dry, loose, flows through fingers	Dry clods, breaks down into powdery condition	Hard, baked, cracked surface, loose crumbs on surface
50% or less	Appears dry, will not form a ball	Appears dry, will not form a ball	Crumbly, holds together with pressure	Pliable, will form a ball under pressure
50% to 75%	Appears dry, will not form a ball	Will form a ball, will not hold together	Forms a ball slight slick with pressure	Pliable, will form a ball under pressure
75% to field capacity	Sticks together, forms a weak ball	Forms a weak ball, will not become slick	Forms a ball, very pliable, readily forms a slick	Easily ribbons between fingers
Field capacity	Under pressure	Under pressure	Under pressure	Under pressure

“Hands-On” gives in-field guidelines for identifying field moisture. This is an estimate only. Adapted from R. H. Coppock (Eds.), Saving Water in Landscape Irrigation, University of California, division of Ag. Science leaflet 2976 (1978).

# VAPAM Drip Fumigation Guide

## System Considerations

Emitters along the drip tape should be placed no more than 12 inches apart. The position of the drip tape is an important factor in the effective distribution of VAPAM in the plant bed. Best results are obtained when the tape is positioned on the bed surface under the tarp (plastic). The system should be divided into quadrants, which are sized to provide uniform distribution of the water and the VAPAM.

## Soil Preparation

The soil should be prepared and tilled properly. Pre-irrigate to initiate weed seed germination and activation of soil-borne pests. The beds should be free of clods and firmly packed. The plastic tarp used over the shaped bed should not have holes or tears.

# VAPAM Ground Application Guide

## VAPAM Application and Field Conditions

- 1. Moisture in the field is essential for optimum activity of VAPAM. Soil moisture should be 60% to 80% of field capacity.**
- 2. A pre-irrigation prior to application, to thoroughly wet the treatment zone, is recommended seven to 10 days prior to application.**
- 3. If drying conditions occur prior to application, a second irrigation should be made to ensure proper moisture during application.**
- 4. Field should be in seedbed condition, free of clods.**
- 5. Proper calibration and proper rate.**
- 6. Proper placement of product.**

Follow the VAPAM label directions for Worker Protection Standards. The MSDS also provides additional information about the safe handling of VAPAM.

## Spray Blade Application (for a weed control band)

- 1. Apply only on pre-formed beds — this will ensure accurate placement of product and assist in decapping.**
- 2. Product should be applied at a depth of three to four inches from the top of the pre-formed bed.**
- 3. The soil cap should be five to nine inches, covering more than the width of the blade application.**
- 4. The soil cap should not be cloddy, or slab with excessive moisture. The capping soil should be in good tilth to prevent volatilization of VAPAM (MITC).**
- 5. The nozzle should have a spray width adequate to cover the width of the spray blade.**
- 6. Decapping should not be deeper than the bed top.**

## Amount of Water

To ensure optimal control of pests, fumigation must be done with an appropriate amount of water. In loamy soils, an application of 1.75 inches of water will wet more than 20 inches deep. Although VAPAM will volatilize and may move beyond the wetted zone, the best treatment occurs within the wetted area. Application of VAPAM in less than 1.5 inches of water often results in poor fumigant distribution and high volatilization losses, which diminishes the fumigant's ability to control soil-borne pathogens and other pests. Drip fumigation with a larger amount of irrigation water will result in better fumigant distribution in soil, and will reduce fumigant volatilization losses. In sandy and loamy sand soils, limited lateral water movement may limit fumigation distribution. Poor water distribution will result in poor fumigation and therefore poor results.

## Shank Injection Application

This method of application must be tailored to the pest. Weeds and disease applications require different methods of placement than for nematodes. Contact your retailer or local AMVAC representative for specific recommendations, but generally:

- 1. Product should be applied at a depth of six to eight inches.**
- 2. Shanks should have two outlets, one at a depth of three inches and the other at five to six inches.**
- 3. Shank spacing should be no more than four inches apart.**
- 4. Application should be sealed with a soil cap or by using a bed shaper and/or roller.**
- 5. Moisture should be adequate to form a soil seal when a soil cap is not used.**

## Rotary Tiller or Power Mulcher Application

- 1. Tines should be "L" or "C" shaped. Straight tines should not be used.**
- 2. When using shanks to apply the product ahead of the power tiller, the shanks should be four to five inches apart. The application and incorporation should be done in front of soil covering equipment such as bed shaper, and/or a roller/packer to smooth, compact and seal the soil surface.**
- 3. When spraying VAPAM immediately ahead of the power tiller, the tiller should be set to cut at a depth of five to six inches followed immediately with a roller/packer to smooth and seal the soil surface.**

Choose the application method that best suits the target pest, so the method of application will place the highest concentration of VAPAM in that section of soil profile where the pest is located. VAPAM should be placed at or slightly below the target pest. Regardless of the method of application, certain conditions must be met to ensure VAPAM's effectiveness in controlling "target pests." Consult the label for additional information.



MITC is the primary biologically active ingredient.





## Key Aspects of VAPAM for Optimum Pest Control

- > A lethal concentration of MITC must be present while the target species is actively respiring.
- > Re-infestation of the treated zone must be avoided after the application.
- > Avoid trashy soil, which can protect the pest or prevent the soil from being properly sealed.
- > Pre-irrigation is essential to enhance pest susceptibility and optimum release of MITC (see Mode of Action section on p.14).
- > The fields to be treated should be in seedbed condition to ensure optimum pest control (i.e., loosen soil deeply and thoroughly).
- > Soil temperature should be optimum (50°F – 90°F) for the pest development (40°F – 90°F in the Pacific Northwest and Midwest).
- > Prevent the loss of MITC from the soil (i.e., by tarp, using a water or soil cap).
- > Eliminate or minimize soil movement (tillage) after a VAPAM application.

## Testing of Treated Soils Before Planting

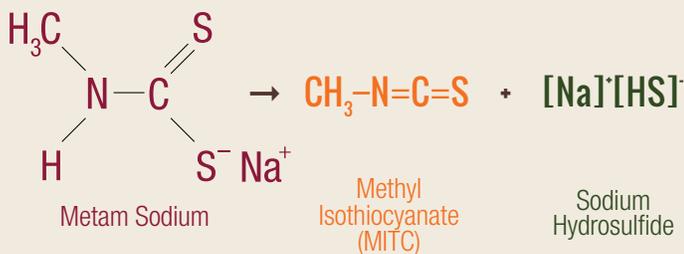
The information below describes a simple test to assay for harmful residual soil fumigants before planting.

### Lettuce Seed Test

1. **With a trowel, dig into the treated soil to or just below the depth of application. Remove two to four small (one to two ounces) soil samples, mix lightly and immediately place a portion in an air-tight jar so that fumes will not escape. Use mason, wheat germ or similar jars with gas-tight lids.**
2. **Sprinkle lettuce seeds on the moistened surface of the soil and recap immediately. Prepare a similar jar with untreated soil (untreated check) for comparison.**
3. **Keep the jars at 65°F to 85°F; do not place in direct sunlight. Direct sunlight may kill the seeds by overheating. Lettuce seeds will not germinate in the dark.**
4. **Inspect the jars for germination in one to three days.**
5. **The soil is safe for planting if seeds in the treated jar germinate the same as seeds in the untreated jar.**

**IMPORTANT:** Be sure: (1) to sample the field properly in several areas, particularly low, wet areas; (2) the lids are air tight and have no grit under the seal; and (3) the jars are placed in indirect sunlight.

## TRANSFORMATION



MITC is the primary biologically active ingredient.

## IN SUMMARY



## RATES OF METAM DECOMPOSITION IN DIFFERENT CALIFORNIA SOILS

SOIL TREATED	SOIL COMPOSITION		% METAM DISAPPEARED	
	% CLAY	% ORGANIC MATTER	1 min.	60 mins.
Egbert Peat	—	34	94	100
Bowers Clay	48	5	70	100
Sacramento Clay Loam	32	4.3	70	100
Yolo Clay Loam	33	2.1	64	100
Sorrento Loam	18	1.8	70	94
Salinas Silty Clay Loam	19	1.9	54	93
Holtville Silty Clay	39	1.4	46	92
Chualar Coarse Sandy Loam	9	0.6	36	74
Santa Cruz Loamy Sand	5	3.6	39	74
Greenfield Sandy Loam	7	2.8	36	71
Hesperia Sandy Loam	5	0.4	17	43
Hanford Sandy Loam	—	—	0	28
Builders Sand	—	<0.2	0	10

Dr. Reed Gray, Stauffer Chemical Company, Mt. View, CA

### Mode of Action and Behavior in the Soil

VAPAM soil fumigant from AMVAC can be used prior to planting most food or fiber crops grown in the United States. Once in the moist soil, VAPAM becomes a powerful biocide that can significantly reduce nematode populations, suppress fungi and bacteria and effectively reduce weed seeds in the treated zone. Within approximately 14 to 21 days following application, VAPAM degrades to naturally occurring components containing carbon, hydrogen, sulfur, sodium and nitrogen.

### Degradation

Although diluted aqueous solutions of VAPAM in applicator tanks can be relatively stable for several hours, up to a few days, dilute applications of VAPAM degrade rapidly in soils to methyl isothiocyanate (MITC), which is the product's primary bioactive agent. The time required for total decomposition of VAPAM to MITC ranges from minutes to several hours, depending upon soil type, soil temperature, soil moisture, pH and other factors. (Conversion to MITC can take longer in soils with low pH and at cold soil temperatures.)

The biological activity of MITC is believed to be caused by the chemical inactivation of biochemically important thiol groups within cells. The thiocyanate reacts with enzymes containing free sulfhydryl groups.

Soils with high clay contents exhibit higher rates of degradation of VAPAM. Soil high in organic matter and clay absorb more MITC than soils with little or no clay and organic matter.

The rate of VAPAM degradation is strongly dependent upon the moisture content of the soil as well as on the concentration of VAPAM in the aqueous phase. For conditions prevailing in soils during and after irrigation (concentration of up to 320 ppm VAPAM and moisture content saturation of up to 40% to 60%), the breakdown of VAPAM is rapid enough that the main component in the percolating water will be MITC.

MITC breakdown in coarse-textured soils (less than 20% clay) is slow enough that the solution concentration remains in the soil long enough to be effective. In fine-textured soils, absorption of MITC might cause a significant delay in MITC advance through the soil, necessitating higher initial concentrations of VAPAM, particularly when applied through irrigation systems.

The rate of breakdown of VAPAM is also increased by high temperature, low moisture and high pH. The degradation of VAPAM is more rapid in soil than in dilute solutions.

Upon application, dilute VAPAM moves through the soil passages, with high concentrations moving toward areas with lower concentrations. Under normal soil conditions, VAPAM reacts with soil constituents to produce MITC. Although there are several pathways of degradation for VAPAM, under most soil conditions, MITC further breaks down into hydrogen sulfide and/or carbon disulfide (of which both can also exhibit biocidal activity), and finally to molecules containing carbon, hydrogen, sulfur and nitrogen. Allow 14 to 21 days after an application to pass before planting. If an application is under a totally impermeable film/tarp (TIF), it may take 30 days before it is safe to plant.

## Movement in the Soil

The vertical and horizontal movement of VAPAM in the soil is primarily dependent on water movement, which is dependent on many factors. The most important are soil type (hydraulic conductivity and water holding capacity), initial soil moisture condition, soil compaction, presence of shallow subsurface impermeable layers, water table and rate/volume of water delivery. Additional factors, which affect water infiltration and radial movement, will also affect the movement of VAPAM through the soil profile, both horizontally and vertically.

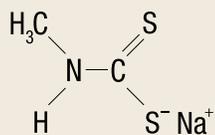
VAPAM is extremely soluble and moves with the waterfront. Osmosis is the “driving force” for moving VAPAM throughout the soil profile. VAPAM will move from areas of high concentration to areas where there is little or no concentration (i.e., concentration gradient). VAPAM fumigation activity will not move vertically or horizontally past the point moved by the water front.

Due to the unique behavior of VAPAM in the soil, the primary keys to proper distribution of VAPAM are concentration gradient and saturated soil. Without both of these, poor movement of VAPAM in the soil can result. This is the primary reason why AMVAC recommends pre-irrigation prior to treatment with VAPAM if soils are not already saturated at 60% to 80% percent field capacity.

## CHEMICAL AND PHYSICAL PROPERTIES

**Chemical Family:** Dithiocarbamate

**Chemical Name:** Sodium methyldithiocarbamate



**Molecular Wt.:** 129.17

**Color & Form:** Crystalline sodium methyldithiocarbamate is an unstable white solid. Formulation can be colorless or a light green to light yellow liquid.

**Boiling Point:** 112°C/234°F

**Crystallization Point:** 0°C to 20°C depending on product strength

**Specific Gravity:** 1.208 g/ml @ 20°C/4°C (68°F/39°F)

**Density:** 10.06 lb/gal

**Vapor Pressure (mm/Hg) –** 24 mm Hg @ 250C

**Percent Volatile by Vol:** Not available

**Solubility in Water –** Miscible

## Stability and Reactivity

### Chemical Stability (conditions to avoid)

This product is unstable as dilute water solution, decomposing to methyl isothiocyanate (MITC), and will also slowly degrade in the presence of air. As originally packaged, it is stable under normal storage conditions for up to two years.

### Incompatibility

This product is incompatible with strong aqueous acids. In addition, it is corrosive to copper, brass and zinc, and may soften and/or discolor iron.

### Hazardous Decomposition Products

When treated with water or heated to decomposition, this product will give off toxic fumes of methyl isothiocyanate (MITC), hydrogen sulfide, and nitrogen oxides.

### Hazardous Polymerization

This product will not polymerize.

### Carcinogenicity

Laboratory studies have shown some developmental and carcinogenic effects in laboratory animals. Exposure monitoring studies conducted during agricultural applications of metam sodium have shown that human exposure is extremely low; therefore, any potential risk to humans from metam sodium exposure is considered minimal. Care should be exercised and all label instructions should be followed, in the handling of VAPAM Soil Fumigant.

## Ecological Information

This product is toxic to fish. Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash waters.

## Disposal Considerations

This product is not an RCRA hazardous waste. Disposal must be at an approved waste facility for chemical wastes. The empty container must be triple rinsed prior to disposal.

Consult the label and with state and local disposal authorities for the actual method(s) to be followed.



This product is excluded from listing requirements under Environmental Protection Agency and the Toxic Substances Control Act (EPA/TSCA).

## U.S. Federal Regulations

This product is registered under EPA/FIFRA regulations. It is a violation of federal law to use this product in any manner inconsistent with its labeling. Read and follow all label directions. This product is excluded from listing requirements under EPA/TSCA.

## SARA Title III Data, Section 311 and 312

### HAZARD CATEGORIES

Immediate Health Hazard	Yes
Delayed Health Hazard	Yes
Fire Hazard	No
Reactive Hazard	No
Sudden Pressure Release Hazard	No

Consult the VAPAM MSDS for additional information on hazards, handling, toxicology, shipping, storage, and Personal Protective Equipment for handling.

### Definitions

**Buffer Zone:** An area established around the perimeter of each application block. The buffer zone must extend outward from the edge of the application block perimeter equally in all directions.

**Buffer Zone Period:** Begins at the start of the application and lasts for a minimum of 48 hours after the application is complete. Non-handlers must be excluded from the buffer zone during the buffer zone period.

**Entry Restricted Period:** This period begins at the start of the application and expires five days after the application is complete. If tarps are used, this period ends when tarps are perforated and removed. Entry into the application block during this period is only allowed for appropriately PPE-equipped handlers performing handling tasks.

#### Difficult to Evacuate Sites:

- > Pre-K to grade 12 schools
- > State-licensed daycare centers
- > Nursing homes, assisted living facilities
- > Hospitals, in-patient clinics
- > Prisons

### TOXICOLOGICAL INFORMATION

Ingestion	Oral LD50 (rat)	812 mg/kg
Inhalation	Inhalation LC50 (rat)	2.28 mg/L
Dermal	Skin LD50 (rabbit)	>2,020 mg/kg
Eye Irritation	—	Corrosive
Skin Irritation	—	Corrosive
Other	Skin sensitization (guinea pig)	Sensitizer

For more information about VAPAM HL, contact your local agricultural chemical retailer, call 1 888 GO AMVAC (1 888 462 6822) or visit [www.amvac-chemical.com](http://www.amvac-chemical.com).

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Always read and follow label directions. [www.amvac-chemical.com](http://www.amvac-chemical.com).



# FUMIGANT CONTACT PAGE

## Fire

911 \_\_\_\_\_

## Police

911 \_\_\_\_\_

## State Ag Contact

Name \_\_\_\_\_

Phone \_\_\_\_\_

## Local Ag Contact

Name \_\_\_\_\_

Phone \_\_\_\_\_

## Neighbors

Name \_\_\_\_\_

Phone \_\_\_\_\_

Name \_\_\_\_\_

Phone \_\_\_\_\_

Name \_\_\_\_\_

Phone \_\_\_\_\_

Name \_\_\_\_\_

Phone \_\_\_\_\_

## Owner

Name \_\_\_\_\_

Phone \_\_\_\_\_

## Farm Manager

Name \_\_\_\_\_

Phone \_\_\_\_\_

## Other

Name \_\_\_\_\_

Phone \_\_\_\_\_

Name \_\_\_\_\_

Phone \_\_\_\_\_

## EPA Regional Offices

Region 1 / New England  
(ME, NH, VT, MA, RI, CT)  
(888) 372-7341

Region 2  
(NY, NJ, Puerto Rico and U.S. Virgin Islands)  
(212) 637-4040

Region 3 / Mid-Atlantic  
(DC, DE, MD, PA, VA, WV)  
(800) 438-2474

Region 4 / Southeast  
(MS, TN, AL, GA, FL, KY, SC, NC)  
(800) 241-1754 or (404) 562-9900

Region 5 / Upper Midwest  
(IL, IN, MI, MN, OH, WI)  
(312) 353-2000

Region 6 / South Central  
(AR, LA, NM, OK, TX)  
From Region 6 states, (800) 887-6063

Region 7 / Midwest  
(IA, KS, MO, NE)  
(800) 223-0425

Region 8 / Mountains and Plains  
(CO, MT, ND, SD, UT, WY)  
From Region 8 states, (800) 227-8917

Region 9 / Pacific Southwest  
(AZ, CA, HI, NV, Guam, American Samoa)  
(415) 947-8713

Region 10 / Pacific Northwest  
(AK, ID, OR, WA)  
(800) 424-4372 or (206) 553-4973

Poison control (800) 222-1222  
National Pesticide Information Center, in case of a spill, (800) 858-7378

**AMVAC (888) 462-6822**  
**amvac-chemical.com**

